THURSDAY, DECEMBER 7, 1876

THE YORKSHIRE LIAS

The Yorkshire Lias. By Ralph Tate and J. F. Blake. (London: Van Voorst, 1876.)

IT might at first sight seem a piece of presumption in one whose palæontological attainments are of the slenderest, and who knows no more of the Yorkshire Lias than has been picked up during a few days ramble along the coast, to attempt a criticism of a work conspicuous for elaborate palæontological research and rich in descriptive detail of the most minute and local character. But in forming an estimate of the work of a specialist the absence of minute special knowledge is in many cases far from being a disadvantage; the specialist always runs some risk of becoming engrossed with details, of looking upon them as the end and not as a means to something higher, of being "unable to see the wood for the trees," and, as long as this risk exists, there is always a fair prospect that the remarks of an outsider, however inferior he may be in special attainments to the man whose work he is reviewing, may add something in breadth of view, and may suggest questions that have been overlooked in the task of collecting minute particulars. It is with this feeling that we attempt to give an account of the work before us, and to discuss some problems which its perusal has suggested to us; and we make the attempt all the more readily, because the authors have by no means in the multiplicity of their details lost sight of the broad questions which underlie and spring from them.

The opening chapter on the "General Range of Liassic Strata on the Continent and British Isles" would have been better for rather more copious references. The authors quoted may be well known to the mass of professional geologists, but if this book comes, as we feel sure it will, into the hands of workers of a more amateur class, mainly occupied with the geology of their own neighbourhood, but at the same time anxious to understand its relation to that of corresponding districts abroad, many of its readers will certainly be glad of directions where to find the papers of geologists not familiar to the world at large, and whose names they perhaps now meet with for the first time. This indifference to references is a growing and a very serious evil; take, for instance, such a book as Marcou's "Explication de la Carte Géologique de la Terre;" to attempt to give in 200 pages a complete account of the geology of the globe would be a hopeless task, but an outline no longer than this, abundantly furnished with references, would be a work whose value it would be difficult to overestimate; unluckily M. Marcou has fallen into the prevalent carelessness in this respect, and for every reference he has given, ought to have supplied fifty.

Chapter II. gives an account of the literature of the Yorkshire Lias; the abstracts of the various papers and works on the subject are admirable for point and conciseness, and the criticisms fair and just. In Chapter III. the range and general character of the Lias in Yorkshire are clearly sketched out.

The fourth chapter lands us in one of those disputes, unavoidable possibly in the present state of geological nomenclature, which have far too much the look of fighting about mere words to be altogether satisfactory. The point at issue is, where should the line be drawn between the Lias and the Inferior Oolite? In some cases the demarcation between the two formations is both lithologically and palæontologically so sharp as to leave no room for hesitation; but some sections show a group of beds in which fossils that occur in the Upper Lias are found side by side with others generally looked upon as characteristic of the Inferior Oolite. Here, then, was a fine battle-ground for the systematists, and here, accordingly, as in other analogous cases, much good ink and paper has been—shall we dare to say—wasted in discussing whether the problematical strata ought to be called Liassic or Oolitic. Dr. Wright maintains the first view, and the authors of the work before us lean to the second, the question being argued by both disputants on purely palæontological grounds; it turns partly upon the correct naming of certain Ammonites, hard to discriminate from one another, and possibly so closely allied that they ought to be looked upon as varieties rather than distinct species; it involves many points on which there is great difference of opinion, such as whether we ought to look mainly to the Cephalopoda or to the Conchifera in determining the relationship of the group; and after carefully considering what has been said on both sides, it certainly seems that it is one of those cases where the impartial bystander would find it so hard to make up his mind that he would be sorely tempted to resort to the unscientific method of "tossing up" to help him to a decision. Fortunately there is a better way out of the difficulty; we are not tied down, as the manner in which the question has been handled would seem to imply, to a single alternative. It is an easy thing to say that there shall be a Liassic group and an Oolitic group, and that of the rocks about the junction, what won't go into one shall be forced into the other, and by adopting this principle very neat tables of strata may be constructed. But if, as the group under consideration proves was the case, there was not a clean sweep of the Liassic forms of life before any Oolitic forms came in, but that to a certain extent the replacement was gradual, then wherever the record of the change in the least degree approaches completeness, beds will occur which contain a mixture of Liassic and Oolitic species, and consequently cannot be placed consistently under either of these heads. It is unfortunate for the symmetry of our classification that it is so, but being so, we must bear the evil as best we may. Perhaps the best way is to let each man *call* the beds in dispute Lias or Oolite as his fancy prompts him, but to be careful to bear in mind that the meaning they carry with them is this—that, when they occur, we have been lucky enough to have preserved a record, which at other spots either never existed or has been destroyed, of the rate at which changes in life that took place between two indistinctly outlined periods of the earth's history were brought about.

It would not, of course, be fair to blame Messrs. Tate and Blake, when they are writing a monograph on the Lias, for explaining what they mean by that term; but it would possibly have been more philosophical if they had looked upon their upper boundary as purely conventional, and noticed the beds above that line as of interest because they show a gradual passage from the life of the period

with which they are specially concerned to the life of the period which followed it.

A dispute of a similar nature arises when we come to the boundary between the Lower and the Middle Lias. The tabulated lists of fossils given by our authors show in the Yorkshire area a marked palæontological break between the zones of *Ammonites oxynotus* and *A. Jamesoni*, and a similar break has been observed at a corresponding horizon both elsewhere in England and on the Continent. Here then German and a large number of English geologists draw the line. But a difficulty arises when we attempt to construct maps according to this classification; unfortunately the marked change in life is not accompanied by a corresponding change in the character of the rocks; the beds above and below the palæontological line are lithologically so much alike that it would be impossible to separate them on a map by the ordinary methods of geological surveying. Somewhat higher in the series, however, a change in lithological character, marked and sudden enough to allow of its being traced with considerable accuracy, does occur, and the field geologist, finding that he can separate on his map the rocks above and below this line, naturally draws a boundary here. Hence it arises that the subdivisions drawn on maps, such as those of the Geological Survey, do not coincide with those established from palæontological considerations. And no harm would follow from this if the lithological line always kept the same place in the series; we should merely have to bear in mind that the boundary laid down on the map was adopted out of sheer necessity, because it was the only line that could be traced, that it did not coincide with any great change in life, but that the palæontological break occurred at a certain distance below it. But in the case before us the hard sandstones and ironstones of the Middle Lias are notoriously irregular and uncertain, and if we make the Middle Lias begin where rocks like these —which can be separated on a map from the clays—first make their appearance, we shall place in the Lower Lias at Banbury beds which we call Middle Lias at Frodingham. In such a case, when the map-maker is driven to neglect or set at defiance palæontological boundaries, the right thing would seem to be that he should call his sub-divisions by names different from those used by the palæontologist; on the Survey maps, for instance, it would be better to drop the terms Lower, Middle, and Upper Lias, and speak merely of Lias Clays, Sandstones, and Ironstones, leaving it to the palæontologist to decide to which of the three sub-divisions the strata distinguished on the map ought in each locality to be assigned. It should be added, however, that Mr. Judd has something to say even from a palæontological point of view for the classification of the Geological Survey;[1] though it must be confessed that his words sound somewhat as if he were dutifully trying to make the best case for a line which his official position rather than his own convictions led him to adopt.

For the painstaking zeal with which the authors have in succeeding chapters worked out the palæontology of the different minor sub-divisions, and described the localities where each may be studied, and for their long and elaborate descriptions and figures of the fossils the thanks of all geologists, and specially of those interested in the district, will be gratefully rendered; and as they have thought it necessary to defend the minute and detailed character of their work, a word may be added on this head. It is somewhat unfortunate that a special term, "zones," has been applied to those lesser sub-divisions, which in common with the majority of palæontologists they have sought to establish. It leads to the notion that a "zone" is something different from a "formation," and to a vague fear that the zone-maker is introducing some new and presumably unsafe method into geological classification. But if, as the evidence seems to show, each zone is characterised not indeed by fossils entirely peculiar to itself, but by certain assemblages of fossils which are not met with in any other zone, then the principle on which zones are established is identically the same with that which determines the larger sub-divisions, and the only difference between a zone and a formation is that the one requires more care and labour to detect and define it than the other. As our authors remark, we are quite in the dark as to the causes that brought about the change from the fauna of one zone to that of the succeeding zone; but just the same remark applies in many cases to the more marked differences between the fauna of successive formations. If, then, the palæontological facts on which zones are based can be securely established, the existence of these minor sub-divisions is a fact which geologists cannot refuse to recognise; but it is just here that the rub occurs. The intolerable complexity and uncertainty of palæontological nomenclature, the utter want of agreement on points of the first importance between many leading palæontologists, the strong tendency which so often exists to a multiplication of species in order to justify existing sub-divisions or even to increase their number, have raised suspicions and distrust in palæontological grouping, unfounded perhaps, but for which palæontologists have only themselves to thank. What can, for instance, be more monstrous than the idea that the time at which it lived ought to be taken into account in the definition of a species? An idea which, according to one of our authors, only a limited number of palæontologists are prepared to repudiate. If you have two creatures exactly alike in every respect, what reason can there be for calling them by different names because one is alive now and the other died ages ago? The idea is closely akin to the old superstition that the volcanic rocks of the earlier periods must have been different from those of the present day, and that if no real difference can be detected between them, they at least ought to be called by different names. Such a notion is now scouted by the most advanced petrologists, and when palæontologists follow in their steps, they may be assured that the objections which some geologists have urged against their smaller and less easily recognised sub-divisions will no longer be heard.

We cannot help thinking that the authors have laid rather too much stress on the littoral character of the Lias in the northern part of the North Riding. They lean to the conclusion that the Lias never extended much further towards the north-west than the points where we now last see it in that direction; in fact one or two of their expressions seem to hint that the Lias of the North Riding was deposited in a basin of its own. This can

[1] "The Geology of Rutland" (Memoirs of the Geological Survey), p. 45.

hardly be admitted; the persistence over large areas of the different palæontological zones of this formation shows that the Liassic sea formed one great life province, and that however it may have been broken up by projecting headlands or insular masses of land, there was free communication between all its parts. That the water was shallower in some places than others is likely enough, and variations in depth would seem to be sufficient to account for the changes which occur in the lithological character of the Lias in North Yorkshire without invoking the neighbourhood of an extensive shore line. A very interesting fact is the decided unconformity between the Lias and the Inferior Oolite east of Easingwold; the upheaval to which it is due was only the forerunner of the still more important movements which a little later on drove back the sea and established estuarine and terrestrial conditions over a large part of the North Riding.

It is not necessary that a scientific work should be a model in point of style, but it is a matter for regret when scientific writers neglect the graces of composition, and it is certainly a blot on the work before us that the writing is occasionally obscure, and that instances of somewhat slipshod English are not uncommon in it.

If we stop here it is not for want of more to say; a book as rich in matter as this would furnish texts for many another lengthy disquisition. We may fairly congratulate the authors on having produced a monograph which will take a high place among standard works on local geology, and may be recommended as a model for writings of a similar kind. We wish every natural geological district in our island was likely to be worked out with the same amount of patient labour and faithful description as Messrs. Tate and Blake have bestowed on the Yorkshire Lias. A. H. G.

OUR BOOK SHELF

Die Fauna der Clavulina Szabói Schichten. Von Max. von Hantken. I. Theil: Foraminiferen. Mit 16 Tafeln. (Buda-Pesth, 1875.)

EVERY visitor to the Loan Exhibition of Scientific Apparatus at South Kensington must have noticed in the Geological Department some beautiful series of preparations of Foraminifera and Bryozoa from Hungary. These have been sent by Dr. von Hantken, the Director of the Hungarian Geological Survey, who has greatly distinguished himself by the remarkable skill with which he has studied these minute fossil organisms. One of these series of fossils, which English geologists have now such a valuable opportunity of studying, illustrates the remarkably rich Foraminiferal fauna of the zone of Clavulina Szabói in Eastern Europe, a fauna which is very admirably described in the work before us. This memoir is a reprint of a portion of the fourth volume of the "Mittheilungen aus dem Jahrbuche der kön. ungar. geologischen Anstalt," which is published in both the Hungarian and German languages.

The Clavulina Szabói Schichten are a series of clays, marls, and marly limestones, sometimes glauconitic, which are situated at the junction of the Eocene and Oligocene formations, and appear to have a wide distribution in Western Hungary. These strata are very remarkable for the wonderful richness of their fauna, especially in Foraminifera, Bryozoa, Echinoderms, and Mollusca, while in certain portions of the formation great numbers of fish-remains have also been found. No less than 213 species of Foraminifera have been described by Dr. von Hantken as occurring in these beds, and their distribution in the Eocene and Neogene strata of Eastern Europe, as well as in the strata which most nearly correspond in geological age with the zone of Clavulina Szabói in Germany and Italy respectively, are shown by the author in a very useful table. The lithographic plates with which this monograph is illustrated are beautifully executed, and reflect the highest credit on the present condition of the art of book-illustration in Hungary. Although the dimensions of each of the forms described is given with great exactness in the definition of the species, we think it is unfortunate that the extent to which each figure is magnified is not also indicated either on the plates themselves or in the descriptions which accompany them.

J. W. J.

Elements of Algebra for Middle-Class Schools and Training Colleges. By Edward Atkins, B.Sc. (Collins's School Series, 1876.)

THIS is a handy book, covering the ground usually occupied by similar treatises on the subject. It is a fairly independent work, keeping near the beaten track as regards results arrived at, but giving these results in many cases by new modes of proof. The chief additional features of interest are in some articles on "Imaginary Quantities," "Properties of Numbers," and "Determinants." We do not like the use of the expression, "It is easily found," and so on, in a few passages, and we must point out that there are a great many mistakes, not merely typographical ones. These are faults which can easily be rectified in a second edition. Care also should be taken to correct the numerous wrong references.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Carl Jelinek

ALLOW me to correct a little inadvertency in the necrology of Carl Jelinek (NATURE, vol. xv. p. 85). In line 8 from commencement "Prague" should be read instead of "Vienna," as the former and not the latter observatory was then under the direction of Kreil. Jelinek passed four years (1843-1847) as assistant in the Vienna observatory, then under my direction, and published in that period a valuable memoir on hygrometrical observations made at Vienna in the years 1829-1845, besides several astronomical observations and computations in the *Astronomische Nachrichten*, and in the *Annals* of the Vienna observatory. CH. DE LITTROW

Vienna, November 29

Ancient Solar Eclipses

IN NATURE, vol. xv. p. 65, is given the result of calculation of the solar eclipse of June 14, B.C. 763.

As soon as notice of the probability of this eclipse was given by Sir Henry Rawlinson (in] May 1867), I asked the assistance of Mr. Hind for its computation. Mr. Hind most kindly acceded at once to my request, and sent to me on June 19, 1867, the following results, which he permits me now to offer to NATURE. They were transmitted to Sir Henry Rawlinson on June 20, 1867, and to Mr. George Smith on October 17, 1867.

SOLAR ECLIPSE, – 762, JUNE 14-15.

Path of Totality, according to the Lunar Tables of Hansen and the Solar Tables of Le Verrier.

Greenwich Mean Solar Time, B.C. 763	Northern Limit.		Central Line.		Southern Limit.	
	Long.	Lat.	Long.	Lat.	Long.	Lat.
	h. m.	° ′	° ′	° ′	° ′	° ′
June 14, 18 54	35 23	37 52	36 3	37 7	36 44	36 20
19 0	38 29	38 53	39 0	38 4	39 43	37 14
19 6	41 33	39 46	42 7	38 54	42 39	38 3
19 12	44 35	40 31	45 4	39 38	45 32	38 46
19 18	47 34	41 9	47 59	40 14	48 23	39 21
19 24	50 32	41 40	50 52	40 45	51 12	39 49

The path of the shadow defined by these numbers differs sensibly from that given in NATURE, vol. xv. p. 65. It passes to the north of Nimrud instead of the south.

With the permission of Mr. Hind, I also transmit the following list of solar eclipses, computed by him, of which the results are preserved in the manuscripts of the Royal Observatory :—

– 885, July 24	...	– 533, Aug. 31	...	A.D.	671, Dec. 6
– 884, July 13	...	– 480, April 18	...		647, Oct. 12
– 769, May 4-5	...	– 479, Oct. 1-2	...		840, May 5
– 762, June 14 (above)	...	– 477, Feb. 16-17			1133, Aug. 1
		– 309, Aug. 14	...		1140, March 20
– 688, Jan. 10	...	– 189, March 13	..		1173, June 11
– 609, Sept. 29	...	– 187, July 16	...		1241, Oct. 6
– 602, May 17	...	– 103, July 18	...		1433, June 17
– 584, May 28	...	– 50, March 6	...		1521, April 6-7
– 556, May 19	...	A.D. 29, Nov. 23	...		1567, April 8
– 548, June 18	...	113, May 31	...		1598, March 6
– 546, Oct. 22	...	237, April 12	...		1652, April 7
– 534, March 17	...	418, July 18	...		

G. B. AIRY

Royal Observatory, Greenwich, December 5

Negretti's Reversible Thermometer and the Arctic Expedition

CAPT. NARES presents his compliments to the editor of NATURE, and requests him to correct a mistake which Capt. Nares inadvertently made in his official report to the Admiralty concerning the late Arctic expedition, and which has been reprinted in NATURE.

In obtaining some deep-sea temperatures, which proved the existence of a sub-stratum of water warmer than that at the surface, the instruments used were the reversible thermometers of Negretti and Zambra, not Casella's. The Casella thermometer was used on other occasions, but not at the time referred to.

H.M.S. *Alert*, Portsmouth, November 30

The Arctic Expedition

TWO or three considerations have led me to believe that possibly the recent Arctic Expedition has not been so fortunate as might have been wished, and that the same amount of foresight, courage, and energy, expended on a similar expedition another year might be attended with much more satisfactory results.

The considerations referred to are these :—

Fifty years ago Sir Edward Parry traversed a distance of some hundreds of miles in sledges upon what he at first supposed to be the main pack ; but on finding that as fast as he travelled northwards he was drifting to the south, he concluded what he had mistaken for the main pack, was after all only a loose floe of immense extent.

Now in 1872, on the return of the American expedition, we were all given to understand that an open Polar Sea existed where instead is now found a sea of ancient ice. All testimony concurred in pointing to this open sea. The climate was warmer than further south ; birds were seen flying north ; a creeping herbage flourished, and bright flowers were not absent. Musk oxen, rabbits, and lemmings also abounded. Now these *Polaris* explorers were neither mendacious nor stupid ; and it seems to me that it is rather premature to set down their inference from all they observed as a mistake.

Now, sir, my theory, true or false, new or old, is this :—This Palæocrystic Sea is really a vast floating island of ice ; say 500 miles in diameter. Just like the ice in a pail or on a pond, it melts in the hot weather at the edges, and then, disengaged from the land, it floats hither or thither, according to the direction of the prevalent winds or currents. If this theory be correct, it accounts for Parry's disappointing journey, for the inferences based on the *Polaris* observations, and for the otherwise unaccountable fact that the ice encountered by the recent explorers is undoubtedly ancient. The fact that the vast floe showed no signs of drifting away last summer only shows that the wind was unfavourable, or that this northernmost Greenland coast, when once the ice is stranded, does not easily relinquish its grasp. Possibly if a *Hecla* had attempted in 1876 what was impracticable in 1827, or if an *Alert* had tried in 1827 what has just proved a failure, both enterprises would have succeeded.

Next time two opposite routes must be undertaken simultaneously, of which one will fail and the other succeed.

WORDSWORTH DONNISTHORPE

17, Porchester Terrace, W.

The Age of the Rocks of Charnwood Forest

IN reference to the letters which have appeared in NATURE (vol. xv. p. 97) allow me to say, in the first place, that I neither attached, nor intended to attach, any discredit to Mr. Woodward's very useful manual for the statements it contains in reference to the age of the Charnwood Forest Rocks. On the other hand, I am gratified to find that so competent an observer as the Rev. T. G. Bonney concurs with me in the view "that there is not a particle of evidence for their Laurentian age." This was the special point of my letter; and I fail to see that Prof. Green's hypothetical inferences from certain sections at Markfield (of which he fears that he has kept no record) are of much value in the question. Prof. Green, however, admits that the great mass of these rocks give no evidence of Laurentian age.

As regards what may be the respective limits of "Cambrian" and "Silurian" rocks that is another question. I am quite aware that Sedgwick claimed formations as "Cambrian" which are not so recognised by the Geological Survey, nor by the majority of authors, continental as well as British ; for example, M. Barrande. To which of the series of formations belonging to the Cambrian system of Sedgwick the forest rocks are to be referred I am not prepared to say ; but I think it must be allowed that the negative evidence founded on the absence of fossils ought to have some weight in favour of the view that they are referable to the horizon of the "Cambrians" of the Geological Survey rather than to that of the Llandeilo or Caradoc beds.

Mr. Bonney's comparison of the forest rocks with those of the volcanic series of the Lake District is very suggestive ; nor is the correspondence of the strike of the beds in both districts without its weight, where every circumstance ought to be taken into consideration in question of such uncertainty. It would also be very desirable if some general understanding could be arrived at regarding the respective limits of the Cambrian and Silurian systems. There are scarcely two authors who adopt the same view on this subject. Theoretically it may be a matter of small consequence ; but practically it gives rise to confusion amongst geologists and amongst students of geology. As this is the age of "conferences" why should not a conference of Palæozoic geologists meet and lay down a frontier line for the two kingdoms, which would last, perhaps, for a generation, and until the "instinct of nationality" crops up and brings on another conflict between the inhabitants of Cambria and Siluria, and their allies respectively? EDWARD HULL

Geological Survey Office, Dublin, December 4

"Towering" of Grouse, Partridges, &c.

MOST of your readers doubtless know what is meant by the towering of game-birds ; but, for the sake of those who do not, I will begin by describing the facts. When a partridge, for instance, is hit while on the wing by a few pellets of shot—perhaps only by one or two—the flight may continue for a variable distance ; but, if the bird is a "towerer," a slight irregularity soon begins to show itself, after which the flight rapidly becomes more and more laboured, till eventually the bird ceases its onward motion altogether. The direction of the flight now changes from the horizontal to the perpendicular, and with a rapid fluttering sort of action the bird rises to a variable height, when all motion suddenly ceases, the animal falls like a stone, and the sportsman then knows that when he finds his partridge it will be lying dead on the exact spot where he "marked it down."

Before proceeding to state the cause of these curious movements, I should like to draw more prominent attention to the facts, first, that the time after receiving the wound during which horizontal flight continues is variable ; second, that the limits of variation are tolerably definite, a bird never towering until it has flown some distance after being shot, and never flying any very great distance before towering ; and third, that the height to which the bird rises is also variable, this height being sometimes only 1 or 2 feet, and at other times 40 or 50.

Now I suppose there is not a sportsman in the country who has not witnessed these phenomena scores and scores of times, and I dare say there is scarcely one of that numerous body who, if asked to assign the cause of these phenomena, would hesitate for a moment in his reply. From the time he first saw a bird tower, he has probably satisfied himself that the current hypothesis is the only one that can explain the curious facts; and if his interrogator should venture to doubt that cerebral injury is this cause, he would probably point to a drop of blood in the beak as a final answer to such scepticism. This drop of blood has doubtless always seemed to him such a complete verifition of the current hypothesis, that he has probably never waited to ask himself the following questions:—1. Why is towering so common? The head of a partridge or grouse is a small object, and therefore not likely to be often hit. Moreover, common sense may show that if towering is due to cerebral injury, such injury must be of a very local and definite character as regards the brain: some particular part of that organ must be injured to the exclusion of all other parts, or else the effect would be instant death. This consideration would lead us to expect that towering, if it is due to cerebral injury, should be of exceedingly rare occurrence. 2. Why does a bird always fly some considerable distance before towering? If the action is due to cerebral injury, we should expect the former to ensue immediately upon the infliction of the latter. 3. Why is the distance which a bird flies before towering so variable? 4. Why is the height to which it does tower so variable? 5. Why is it that birds tower most frequently when shot from behind? 6. Why is it that we never see the hole in the skull through which the pellet has passed?

In view of these difficulties besetting the ordinary hypothesis, and in the hope of ascertaining the exact seat of cerebral injury if this hypothesis were the true one, I have last year and this year dissected a number of partridges which I had observed to tower, and in every case I found the cause of death to be the same, viz., pulmonary hæmorrhage. In all my specimens the lungs were gorged with extravasated blood. It thus becomes impossible to doubt that we have here the true cause of towering; and, as is always the case with true causes, examination will show that it is sufficient to explain all the effects. Towering is common, because the lungs expose a large area to receive the shot, and an area which is especially liable to be crossed by a single pellet from a bad marksman when, as is most usual, the bird is shot from behind. The bird always flies a considerable distance after being hit, because it takes time for the blood to pour into the spongy texture of the lungs from the open ends of the severed blood-vessels. The distance flown is variable, because it depends on the size and number of the severed blood-vessels—*i.e.*, the rapidity of the bleeding—which of course is also variable. The height to which the bird towers is variable, because depending on the same cause. The drop of blood in the beak comes from the bleeding lungs through the wind-pipe—the latter organ in most of my dissections having been found full of clotted blood. Lastly, we do not find any indications, either externally or internally, of cerebral injury, for the simple reason that no such injury has taken place.

Any one who is not a physiologist may here ask, Why does pulmonary hæmorrhage give rise to such very peculiar movements as those that occur in towering? The answer must certainly be, that in these towering movements—which, be it remembered, only take place immediately before death—we have to do with the characteristically convulsive movements which in all animals mark the last stages of asphyxia. That in birds these movements should show themselves mainly in the wings, might, I think, be reasonably expected, seeing that the pectorals are the principal muscles in the body—and all sportsmen are aware how the particular birds in question exhibit violent fluttering motions of their wings when dying from any violent cause, just as rabbits, under similar circumstances, exhibit violent galloping motions of their principal muscle-masses in the hind legs. But why the convulsive movements of asphyxia should show themselves in these birds in the form of upward flight, is a question which I cannot answer. It seems, however, to be a question of some interest to the physiologist, and if worked out might possibly tend to elucidate that obscure subject, the mechanism of flight. Of course to investigate the phenomena of towering, asphyxia of birds would require to be produced in the laboratory; and here I must leave the matter in other hands, for although I have a licence to suffocate as many birds as I can in the pursuit of sport, I have no licence to suffocate a single bird in the pursuit of science.

And, in conclusion, may I suggest that those sportsmen who annually conduct their experiments on asphyxia by the thousand, should endeavour to glean from them one result of some little value to science? It would be of interest to know what birds tower and what birds do not. So far as my own observation extends, the peculiarity in question seems to be confined to members of the grouse genus, nearly all the endemic species of which I have observed to tower. But, excepting those species, I have never known any other bird to do so. By publishing this notice in your columns, therefore, I hope to obtain information from any of your readers who may have observed the well-known phenomena in birds of other genera. GEORGE J. ROMANES

Squirrels

ON the lawn before the window near which I am writing is erected a tripod of three lofty poles, at the summit of which is suspended a basket containing nuts and walnuts. The squirrels, of which there are many in the shrubberies and adjoining plantations, ascend these poles, extract a nut from the basket, and quickly make their way down and across the lawn, in various parts of which they bury their nuts, scratching a hole in the green turf, putting in a nut, filling up the hole, and, lastly, with much energy, patting the loose materials with their feet till the filling-up is made firm and solid. This morning for a considerable time only one squirrel was at work, giving me a better opportunity of observing the mode of operation. His journeys were made in all directions, and varied from 5 feet to nearly 100 yards, never, so far as I could observe, going twice to the same place or even nearly so. The squirrels, I am told, forget the spots where they hide the nuts, and in the following spring the lawn, which is very spacious, is dotted with the young plants of nuts and walnuts. As the colours of flowers attracting bees and moths promote fertilisation, so the racy flavour of a nut, irresistible to a squirrel, contributes to the distribution of its kind.

Turvey Abbey, November HENRY H. HIGGINS

Mr. Harris's Challenge to Mathematicians

IN an advertisement in NATURE (vol. xv., p. xxxviii.) Mr. Harris (Kuklos) challenges mathematicians "to examine and disprove if they can" his published demonstration of the value of π. Presumably he reads this publication; if so, we would direct his attention to an article on "Cyclometers and some other Paradoxers" in vol. xii., p. 560, vol. xiii., p. 28. The part which is concerned with his approximation will be found on p. 29. Reasoning, however, which we venture to think will satisfy mathematicians, may not, we fear, convince Mr. Harris.

THE WRITER OF THE ARTICLE

December 4

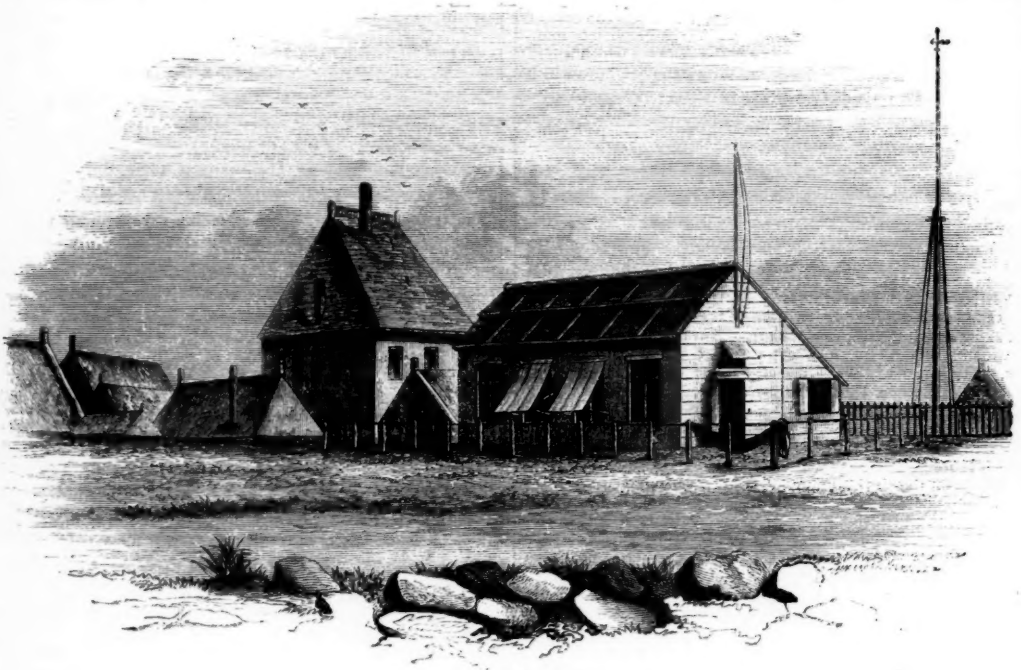
A ZOOLOGICAL STATION ON THE NORTH SEA

REFERENCE was made in NATURE (vol. xiv. p. 535) to the resolutions passed at the recent meeting of the Association of German Naturalists and Physicians at Hamburg, as to the establishment of zoologico-botanical stations on the German coast. The distinguished names of those appointed to draw up a memorandum, which is to be presented to the Imperial Chancellor, the Bundesrath, and the Governments of the several States of the Empire, will no doubt be of the greatest service in securing success to a scheme so universally approved of by all students of biology.

The following is a brief sketch of similar endeavours made in Holland a year ago and of the results arrived at during the summer of 1876:—The Netherlands Zoological Association, at a meeting held in November, 1875, recognised the necessity of founding an establishment on the Dutch coast, where anatomical and microscopical investigations of the fauna and flora of the North Sea might be carried on at leisure, and which could at the same time be made serviceable for physical, chemical, and meteoro-

logical observations on this part of the German Ocean. A committee, consisting of Prof. Hoffmann, Drs. Hoek and Hubrecht was appointed to take the necessary steps towards the realisation of this scheme, and to provide temporary accommodation during the summer months of 1876, where members of the Association might engage in these pursuits. In February, 1876, the Committee was obliged to report that no suitable accommodation was to be found in those localities on the Dutch coast, where the erection of a zoological station might prove a success, and that the funds of the Association would not suffice to carry out the scheme on the scale to which an institution like this ought to aim at from the beginning. The committee proposed to raise the necessary funds by a public subscription as well as by the issue of shares of 10 guilders each, paying no interest, but terminating within a fixed number of years. The Association might thus obtain a building of its own, which, if it were made of wood, might be transportable from one locality on the coast to another according to season and varying abundance of the material for study. This proposal was agreed to, and within a few weeks about 400*l.* were raised, a sum more than sufficient to commence with.

Accordingly a wooden shed similar to those which had served the Dutch astronomical party for the observation of the transit of Venus in Réunion was constructed. It has four windows on each side with corresponding working tables and a small room adjoining, where the vessels containing marine animals may be kept in darkness, and where an apparatus for oxygenising the sea-water is to be kept in constant working order. This embryo zoological station, more resembling a block-house in the back woods than Dohrn's well-known institution, is, however, fitted out with all the requisites for histological and microscopical research prescribed by the different methods of investigation of the present day. Next to the numerous chemical desiderata a store of glass and crockeryware is kept in readiness, a stock of standard works and other



Transportable Zoological Station, 1876.

books which may in any way prove useful is selected from the library of the Association; in short, everything provided for, microscopes and steel instruments only excepted. A set of dredges, towing nets, cross-bars with hempen swabs for scraping the bottom (Marion, Lacaze Duthiers), pelagic nets, &c., complete the inventory, and have to serve for the daily renewal of those marine forms which would be the objects of investigation in the station itself.

In the first week of July all this was transported to Helder, the northern seaport opposite to the Island of Texel, and erected on the top of the great dyke which there protects the Low Countries behind from inroads of the sea. Regular dredging parties were organised, the work being carried on partly in sailing vessels hired for the occasion, partly by means of a small steamer belonging to the Navy, which the Minister of the Marine placed at the disposal of the Zoological Association. The work was carried on for eight weeks; towards the end of August, when continual bad weather set in, the station was closed, taken down, and transported back to Leyden, in order to be erected again on another point of the coast next summer.

During those two months ten members of the Association availed themselves of the opportunity of studying the marine fauna of that part of the Dutch coast, and in many branches interesting results have been arrived at which will in time be published in the Annual Reports of the Association. The shifting sands, which everywhere form the bottom round the coasts of Holland as well as the total absence of rocks and cliffs may explain the deficiency of many sessile forms which form so conspicuous a part of the fauna of the French and British coasts. Crustaceans and Annelids were numerically, perhaps, the best represented; next came the Medusæ, the Hydroid-polyps, the Polyzoa, and different representatives of the classes of Molluscs and Echinoderms. Gephyreans were not met with, neither were Holothurians. As to Ascidians,

they were represented by the composite Botryllidæ, which could be had in immense numbers in some of the shallower parts at the entrance of the Zuyder Zee, mostly attached to blades of the Zostera. The stones employed in the construction of the great dyke, which are partly lying loose, were of importance, as they usually covered over the haunts of numerous Crustaceans, Nemerteans, &c. A no less rich harvest was got from the driftwood now and then met with, and from the wooden palings serving in the construction of the wharfs, &c., in the harbour, which were submerged at high tide.

Altogether this first summer of the Dutch Zoological Station gave ample proof of its practicability. It would perhaps be a good idea to act conjointly in future with the German men of science, and to add a third permanent station to those proposed in the German Committee's Report (Kiel and Heligoland), say at Flushing. If, then, one other station were to be erected on the English or Scotch coast (St. Andrew's Bay ?), a conjoint attack could be made on the mysteries still hidden in that part of the ocean which is inclosed by our neighbouring coasts. The healthy competition which would arise out of this division of the work to be done, can only be favourable to the common end—an accurate knowledge of the natural history of our own seas, and a constant opportunity of studying their animal and vegetable productions in the fresh state.

SENSITIVE FLAME APPARATUS FOR ORDINARY GAS PRESSURE, AND SOME OBSERVATIONS THEREON

A GLASS or metallic tube, about 5 inches long, and $\frac{5}{8}$ in diameter, is closed at one end with a perforated cork, through this cork slides a piece of $\frac{1}{8}$ inch tubing, about 6 inches long. One end of this is either drawn out to a jet, or closed in the blow-pipe flame to reduce its diameter to about $\frac{1}{16}$ inch, and the other end is connected to a gas supply. (Fig. 1.)

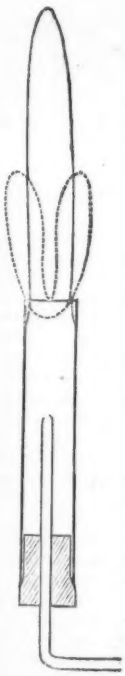


Fig. 1.

The outer tube is held in a suitable support, and the inner tube is pushed through the cork till it nearly reaches the mouth of the outer one, and a light then applied. It now gives a long steady flame.

Experiment I.—Lower the inner tube till the flame is on the point of roaring. It will now be found very sensitive to noise. Snapping the fingers at a distance of eight or ten yards will cause it to contract fully $\frac{1}{4}$ of its height. The most suitable flame for this is about 6 inches high.

Experiment II.—Adjust the gas to give a flame of about $4\frac{1}{2}$ inches high, and gradually raise the inner tube. A point will be reached at which the flame becomes sensitive, not to noise, but note; and it will be found to respond to a certain note by dividing into two portions, and while this note is produced it will continue divided. It is difficult to keep the exact note by whistling with the mouth, and therefore a glass whistle with paper slider should be used, or, better still, a singing tube with adjustment.

Experiment III.—Arrange two singing tubes to give the responding note. The flame divides. Now make one tube a little sharper than the other, so as to beat slowly. The alæ of the flame alternately recede and coalesce.

Experiment IV.—Using the whistle; blow it so hard as to produce higher octaves of the responding note. The flame will be unaffected, as though in perfect silence.

The dimensions of the instrument are open to great variation, and also the size of the flame. For lecture work, a flame $1\frac{1}{2}$ or 2 feet would be more suitable, though less sensitive, and neither dividing nor shortening so perfectly as the sizes given above. It will act effectively with any pressure of gas, from $\frac{1}{10}$ inch (of water) upwards, and the sliding jet makes it equally sensitive with a large or small gas supply.

Observations on the Escape of Gas from Contracted Openings, and on a Differential Pressure Indicator.

Glass tubes of about $\frac{1}{4}$ in. bore are joined as shown in Fig. 2. At D the tube is slightly bent so as to retain a little drop of water. The gas enters at C, and then divides into two channels, one towards B, the other towards A.

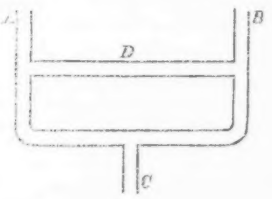


Fig. 2.

If one of the exits be contracted, say B, then the water moves towards A. Certain precautions have to be observed, the conditional arrangements of which need not be mentioned here.

Experiment I.—Connect to each, A and B, a tapering jet, and C with the gas supply. Get the water stationary. Now light, say, B, the water will move towards A, showing that the exit of the gas is retarded by being ignited.

This is rather a remarkable result, seeing that the gas is hotter, and therefore more mobile, and also that the heat must enlarge the aperture. Now light A, and the water will return to zero.

Experiment II.—Connect B with a sensitive flame apparatus, A remaining as before, light and adjust to zero. Now sound the responding note and the water moves towards A, showing that the outflow of gas is retarded by a certain note. Now adjust the sensitive flame for noise, and rapidly snap the fingers or stamp the foot, and the water will still move towards A.

Experiment III.—Arrange as in II., then extinguish the sensitive flame and readjust to zero. Produce the responding note, and the same movement of the water will be observed. This shows that an issuing jet is affected in the same manner by a sound, whether ignited or otherwise.

Experiment IV.—Fix the sensitive flame apparatus adjusted for note under a large jar open at both ends. A large stoppered gas jar answers very well. Fix three balls of spongy platinum, *a*, *b*, and *c*, upon a piece of thin platinum wire so that the point of the quiescent flame just reaches *b*, and the points of the responding flame reach *a* and *c* respectively. Now extinguish the flame without turning off the gas. The issuing gas will cause the ignition of *b*. Now sound the responding note, and *b* will cool, and *a* and *c* will be ignited. This confirms the previous observations, and forms a rather pretty lecture experiment. The object of the gas jar is merely to protect from air currents.

R. H. Ridout

ON THE CONDITIONS OF THE ANTARCTIC[1]

II.

ALTHOUGH no land *débris* of any kind was observed by us on the icebergs, there cannot be the slightest doubt that such is carried by them all over the region and distributed on the bottom. The samples brought up by the sounding instrument consist almost entirely of comminuted clays and sands, and the dredge always contained in considerable quantity, about the meridian of 80° E., chiefly basaltic pebbles, and, further to the eastward, pebbles and larger fragments of metamorphic rocks, granite, gneiss, mica-slate, hornblende-slate, clay-slate, and chlorite-slate.

While the evidence may be said to be conclusive that these icebergs have their origin on land, it seems to me that the presumption is greatly in favour of the land at their breeding-place having been comparatively low and flat, and bordered for a considerable distance by shoal water. Although the white ice which forms the exposed portion of the flat-topped southern icebergs is very hard, its specific weight is considerably below that of absolutely compact ice. Allowing for this difference, and supposing that one-seventh part of the ice is raised above the water, supposing also that the berg is symmetrical in form, which, from its appearance and probable mode of origin is likely to be the case; before it has been subjected to the action of the sea, the submerged portion would be 1,200 feet in depth, the berg would float in water 200 fathoms deep, and the average thickness of the land ice-cap would be 1,400 feet. From the comparatively small number of icebergs at the point where we crossed the Antarctic circle, and so far as we could judge from our own observations and the previous observations of others, for a considerable distance to the west of the meridian of 80° E., we were led to believe that the place of their formation, the land and the belt of shallow water girding it, was at a very considerable distance from us.

Although in the present state of our knowledge it would be rash to form any very definite opinion as to the conditions of the region included within the parallel of 70° S., still there are some indications which have a certain weight. We have no evidence that this space which includes an area of about 4,500,000 square miles, nearly double that of Australia, is continuous land. The presumption would seem rather to be that it is, at all events, greatly broken up, a large portion of it probably consisting of groups of low islands united and combined by an extension of the ice-sheet. One thing we know, that the precipitation throughout the area is very great, and that it is always in the form of snow, the thermometer never rising, even in the height of summer, above the zero of the centigrade scale.

Various patches of Antarctic land are now known with certainty, most of them between the parallels of 65° and 70° S.; most of these are comparatively low, their height, including the thickness of their ice-covering, rarely exceeding 2,000 to 3,000 feet. The exceptions to this rule are Ross's magnificent volcanic chain, stretching from Balleny Island to a latitude of 78° S., and rising to a height of 15,000 feet; and a group of land between 55° and 95° west longitude, including Peter the Great Island and Alexander Land, discovered by Bellingshausen in 1821; Graham Land and Adelaide Island, by Biscoe, in 1832; and Louis Philippe Land, by D'Urville, in 1838.

The remaining Antarctic land, including Adelie Land, discovered independently by Dumont D'Urville, and Lieut. Wilkes, in 1840, in long. 140° 2′ 30″, lat. 66° 45′ S.; Clairie Land, discovered by the same navigators about 3° farther to the westward; Sabrina Land, discovered by Balleny, in 1839; and Kemp Land and Enderby Land, discovered by Biscoe, in 1833, nowhere rise to any great height. If we were justified in adding the "strong appearances of land" reported by Lieut. Wilkes, which would virtually connect Ringgold's Knoll not far from the Balleny Islands, with a point in long. 106° 18′ 42″ E., lat. 65° 59′ 40″ S., by a continuous coast-line of moderate height, the extent of land of this character would be considerably increased.

The geological structure of the Antarctic Land is almost unknown. South Victoria is actively volcanic and consists doubtless of the ordinary volcanic products. D'Urville's party landed on Adelie Land and found rocks of gneiss. Wilkes reports having landed on an iceberg, long. 106° 18′ 42″, and finding "imbedded in it in places boulders, stones, gravel, sand, and mud or clay. The larger specimens were of red sandstone and basalt." At the same place Lieut. Ringgold found that "the icebergs near at the time presented signs of having been detached from land, being discoloured by sand and mud." From one iceberg he procured several pieces of granite and of red clay which had been frozen in. Beyond these observations, and our own on the nature of the pebbles brought up by the dredge, we have no information.

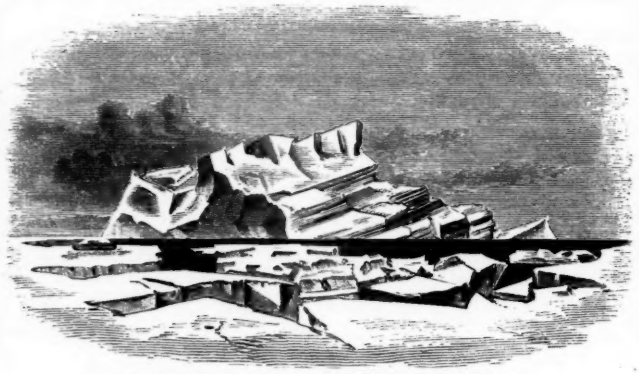


FIG. 3.—February 25, 1874. Lat. 63° 49′ S, Long. 94° 51′ E.

That the area within the parallel of 70° S. is continuously solid, that is to say, that it is either continuous land or dismembered land fused into the continental form by a continuous ice-sheet, I think there can be little doubt. The local cases of abnormal distribution of temperature which produce such remarkable conditions of climate even within the North Polar Sea exist in the southern hemisphere only to a very slight degree; and we know by the absence of any well-defined local Antarctic return-currents comparable with the Labrador current, or the current round the south of Spitzbergen, that the function of such currents as the Gulf Stream in ameliorating the northern climate, and breaking up the ice, and producing a circulation even in the highest northern latitudes, is not in any way represented in the south.

In favour of the view that the area in question is broken up, and not continuous land, two considerations appear to me to be very suggestive. If we look at an ice-chart we find that the sea is comparatively free from icebergs, and that the deepest notches occur in the "Antarctic continent" at three points, each a little to the eastward of south of the great land-masses, and I have little doubt that the explanation of this fact lately suggested by Dr. Neumayer is the correct one. The great equatorial current impinging upon the eastern coasts of the continents bifurcates upon

[1] The substance of a lecture by Sir C. Wyville Thomson, F.R.S., delivered in the City Hall, Glasgow, on November 23, under the arrangements of the Glasgow Science Lecture Association.] Continued from p. 106.

each, and both branches acquiring a slight but decided easterly set by their excess of initial velocity, pass northwards and southwards directed for a time by the land coasts. But the fate of the southern is very different from that of the northern branches. Instead of accumulating and "banking down" in the confined gulfs, the Atlantic, the Pacific, and the Indian Oceans, they at once pass into the waste of the "water hemisphere," and are almost merged in the great drift current which sweeps round the world occupying a belt from 600 to 1,000 miles broad in the southern sea. But while the greater portions of the Brazilian current, the East Australian current, and the southern branch of the Agulhas current are thus merged they are not entirely lost; for at their points of junction with the drift current of the westerlies the whole belt of warm water is slightly deflected to the southward, and it is opposite these points of junction that we have the comparatively open sea and the penetrable notches in the southern pack.

Thus Ross, in 1841 and 1842, after forcing his way through the moving pack, which he found sufficiently open to allow of his doing so, passed between the meridians of 170° E., and 170° W., to the latitude of 78° 11′ S. Weddell in 1823, and Ross in 1843, reached the parallels of 74° 14′ and 71° 30′ S. respectively, between the meridians of 15° and 30° W. The case of the Brazilian current is, however, a little more complicated than that of the others, for there is high and extensive land between the meridians of 55° and 65° W., in 65° south latitude, and the warm current already led far to the southward by the south-American coast appears to bifurcate upon Graham Land, and to produce another bight, in 90° west longitude, a little to the west of the southern point of the South American Continent. In this bight, Cook, in 1771, and Bellingshausen in 1821, pushed nearly to the 70th parallel of south latitude.

The opening caused by the deflection of the southern branch of the Agulhas current towards Kerguelen and the Heard Islands, has not yet been fully explored, but what has been already done in that direction seems to be in striking confirmation of this view. We had indeed arrived independently at the same conclusion before reading Dr. Neumayer's paper. At the point where we crossed the Antarctic Circle (Long. 78° 0′ E.), and for some distance to the westward there were few icebergs, and the sea was almost clear to the south-west. It was Capt. Nares' opinion that had it been considered desirable and had the attempt been made earlier in the season, it would have been easy for us to have pushed southwards in that direction—how far we had no means of ascertaining—but the pack was moving about round us, and for the reasons already given we believed the barrier to be at a considerable distance.

But we not only observed the effect of the influx of warmer water; we were able to detect its presence by the thermometer. Referring to the results of a serial temperature-sounding of February 14, with a surface-temperature of − 1°·2 C., between 300 and 400 fathoms there is a band rising to more than half a degree above the freezing-point. That this warm layer is coming from the north there is ample proof. We traced its continuity with a band at the same depth gradually increasing in warmth, to the northward; and it is clear that its heat can be derived from no other source, and that it must be continually receiving new supplies, for it is overlaid by a band of colder water tending to mix with it by convection.

It is of course possible that the three warm currents may, by coincidence, be directed towards three notches already existing in a continental mass of land; but such a coincidence would be remarkable, and there is certainly a suggestion of the alternative, that the "continent" may consist to so great an extent of ice as to be liable to have its outline affected by warm currents.

The second consideration is that during summer, the only time when these regions have been as yet visited, the greater part of the outline of the area representing the Antarctic continent has been found to consist of moving ice-pack. The prevailing winds within the Antarctic Circle are from the south-east, and as a rule the pack and the icebergs are moving to the westward, and fanning out from a centre. Almost all the navigators who have passed the belt of pack have received the impression that there was open water within, that, in fact, by that time, late in the summer, the pack of the year had been drifted a considerable distance from its nucleus—the land or the continuous ice-sheet. If this be so it would at all events indicate that the "Antarctic continent" does not extend nearly so far from the Pole as it has been supposed to do.

I conceive then that the upper part of one of these tabular icebergs, including by far the greater part of its bulk and culminating in the portion exposed above the surface of the sea, was formed by the piling up of successive layers of snow during the period, amounting perhaps to centuries, during which the ice-cap was slowly forcing itself over the low land and out to sea, over a long extent of gentle slope, until it reached a depth considerably beyond 200 fathoms. The lower specific weight of the ice then caused an upward strain which at length overcame the cohesion of the mass, and portions were rent off and floated away. If this be the true history of the formation of these icebergs, the absence of all land *débris* on the portion exposed above the surface of the sea is readily understood. If any such exist it must be confined to the lower part of the berg, to that part which has moved upon the floor of the ice-sheet.

The icebergs, when they are first dispersed, float in from 200 to 250 fathoms; when, therefore, they have been drifted to latitudes of 65° or 64° S., the bottom of the berg just reaches the layer at which the temperature of the water is distinctly rising, and is rapidly melted, and the mud and pebbles with which it is more or less charged are precipitated. That this precipitation takes place all over the area where the icebergs are breaking up, constantly and to a considerable extent, is evident from the fact that the matter brought up by the sounding-instrument and the dredge is almost entirely composed of such deposits from ice; for diatoms, *Globigerinæ*, and radiolarians are present on the surface in large numbers, and unless the deposit from the ice were abundant, it would soon be covered and masked by a layer of the exuviæ of surface organisms.

There is one point in connection with the structure of icebergs which is of great interest, but with regard to which I do not feel in a position to form a definite judgment. It lies, however, especially within the province of a distinguished professor in the University of Glasgow, Dr. James Thomson, and I hope he will find leisure to bring that knowledge and experience to bear upon it which have already thrown so much light upon some of the more obscure phenomena of ice. I have mentioned the gradual diminution in thickness of the strata of ice in a berg from the top of the berg downwards. The regularity of this diminution leaves it almost without a doubt that the layers observed are in the same category, and that therefore the diminution is due to subsequent pressure or other action upon a series of beds which were at the time of their deposition pretty nearly equally thick. About 60 or 80 feet from the top of an iceberg the strata of ice a foot or so in thickness, although of a white colour, and thus indicating that they contain a quantity of air, and that the particles of ice are not in close apposition, are still very hard, and the specific gravity of the ice is not very much lower than that of layers not more than 3 inches thick nearer the water-line of the berg. Now it seems to me that this reduction cannot be due to compression alone, and that a portion of the substance of these lower layers must have been removed.

It is not easy to see why the temperature of the earth's crust under a widely extended and practically permanent ice-sheet of great thickness should ever fall below the freezing-point; and it is matter of observation that at all seasons of the year vast rivers of muddy water flow into the frozen sea from beneath the great glaciers which are the issues of the ice-sheet of Greenland. Ice is a very bad conductor, so that the cold of winter cannot penetrate to any great depth into the mass. The normal temperature of the crust of the earth at any point where it is uninfluenced by cyclical changes is, at all events, above the freezing-point; so that the temperature of the floor of the ice-sheet would certainly have no tendency to fall below that of the stream which was passing over it. The pressure upon the deeper beds of the ice must be enormous; at the bottom of an ice-sheet 1,400 feet in thick-

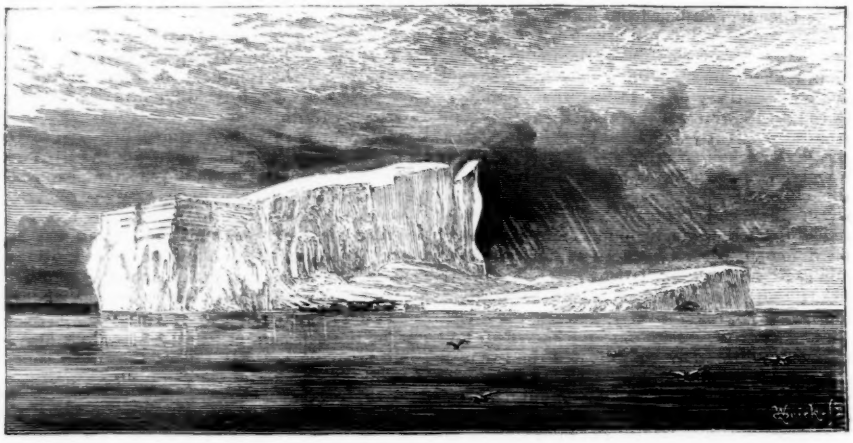


FIG. 4.—Iceberg passed on February 21, 1874. Lat. 63° 30', Long. 89° 6 E.

ness it cannot be much less than a quarter of a ton on the square inch. It seems therefore probable that under the pressure to which the body of ice is subjected a constant system of melting and regelation may be taking place, the water passing down by gravitation from layer to layer until it reaches the floor of the ice-sheet, and finally working out channels for itself between the ice and the land whether the latter be sub-aërial or submerged.

I should think it probable that this process or some modification of it may be the provision by which the indefinite accumulation of ice over the vast nearly level regions of the "Antarctic continent" is prevented, and the uniformity in the thickness of the ice-sheet maintained; that in fact ice at the temperature at which it is in contact with the surface of the earth's crust within the Antarctic regions cannot support a column of itself more than 1,400 feet high without melting.

When the icebergs are drifted in the summer a little to the northward—in the meridian of 80° E. to the parallel of 64° S.—they begin to disintegrate very rapidly. The water at the surface of the sea rises to zero and slightly above it, and dashing against the windward side of the berg, partly by its mechanical action, but more by the constant and rapid renewal of the warm water, it soon wears a deep groove in the face of the cliff. When the groove has cut in so far that cohesion will no longer maintain the weight of unsupported ice, which seems usually to be the case when it is 10 to 15 feet deep, a mass of the cliff falls down, and the weight of the berg being reduced on that side it tilts up more or less and assumes an inclined position; the stratification thus becomes inclined, although it still remains conformable with the plane of the top of the iceberg.

The sea now washes up on the low portion which has been exposed by the tilting of the berg, which it soon reduces to a beautiful curved slope to the bottom of the new cliff, and the process is repeated until by repeated falls of the face of the cliff one side of the berg is so much lightened, that the preponderating weight of the opposite side raises the newly exposed portion out of the water; giving the berg a double outline and the veining a high inclination.

We frequently saw table-topped icebergs with the upper surface very irregular; when that is the case evidence

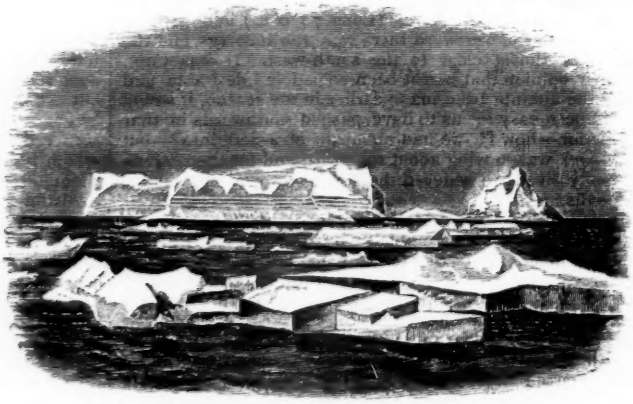


FIG 5.—February 25, 1874. Lat. 63° 49' S, Long. 94° 51' E.

may usually be found from the colour, the closeness of the veining, and other appearances, that it is not the original surface of the iceberg which is now presented to us, but a second surface produced by the cutting away by the sea of an entire story, as it were, of the berg; which although it had no doubt at one time during the process been greatly inclined, had recovered its equilibrium on the whole of the upper layer having been more or less symmetrically removed. Fig. 3 is a view of an iceberg in which the whole of the upper tier seems to be breaking

up and disintegrating under the influence of the air and waves; it is fissured through and through, a large portion has already fallen away, exposing terraces of blue ice previously submerged, and the sea around is cumbered with the fragments. It is easy to see how almost any eccentricity of form may be produced by the irregular action of the waves upon the different sides of an iceberg tilted to different inclinations.

When an accidental hollow or other irregularity on the surface of an iceberg directs the action of the surf on any special point, a cave is speedily formed, and the effect constantly increasing with the deepening of the cavity, the ice is often honeycombed with caverns which penetrate far into the solid berg, and add wonderfully to its beauty by their lovely colouring in shades of cobalt blue, varying with every play of shade and light. The caves are, however, very fatal to the iceberg. From the ice not being thoroughly rigid, whenever the support is taken away from beneath, the layers above bend and give way; vertical fissures are produced which become filled with a breccia of ice and snow, often discoloured by sea-birds; the ice, instead of showing its original uniform horizontal stratification, is distorted into all sorts of anticlinals and synclinals; and fragment after fragment crashes down into the sea.

Fig. 2 gives an idea of the form of a beautiful vaulted berg. The sea was washing through and through it; and as we passed close by, we sat gazing, entranced, at the marvellous beauty of the colouring of the vaults of ice, and the waves, and the snowy spray illuminated by a red setting sun; but our gorgeous iceberg was evidently doomed to speedy destruction. Some glittering pinnacles were the only remains of the buttresses of former arches, and a quantity of *débris* floating round it showed that the whole fabric was undergoing rapid change.

Some few of the bergs which we saw were tilted up to an angle of upwards of 50°, and in various ways—by the inclination of the bergs, by the denudation of successive layers by the action of the sea, and by "dislocations of strata." I believe we saw at various times sections of icebergs to the depth of perhaps 400 feet. All such sections gave simply a continuation of the same phenomenon which we observed in the portion of the berg normally exposed, a gradual approximation of the lines of stratification and deepening of the blue colour.

Sometimes we saw small bergs which were very irregular in form, with all marked prominences rounded off, perfectly clear, and of a deep sapphire blue. These I conceive to be masses of ice from near the base of a berg, which, from extreme shifting of its centre of weight, has turned right over, and exposed the ice near the bottom, in which, by melting and regelation under great pressure, all structure has been lost.

The curious question naturally arises, Shall we ever be able to reach the South Pole? With our present methods and appliances I should think that the answer must be an unhesitating negative. Except possibly somewhere in the region where Ross penetrated, in 1842, to the parallel of 78° to the south of New Zealand, or about Graham Land, where Capt. Dallman, in 1873, continued the explorations of Capt. Biscoe, there seems to be no accessible lead of land; and Ross's southernmost point is upwards of 700, and Graham Land 1,200 miles from the pole. The remainder of the outline of the Antarctic continent appears to be a perpendicular cliff 200 to 250 feet in height, without shelter, and with a heavy pack broken up and kept in motion by frequent gales moving outside it during the greater part of the year, and bounding a vast expanse of glacier surface, a great part of it subject probably to high winds and to almost incessant falls of snow.

We have now learned that the North Pole, if not actually inaccessible, is much more difficult of access than we imagined, even with the long roll before us of the gallant men who have strained through many years the resources of human skill and bravery to the utmost in fruitless attempts to attain the barren issue; and we can only anticipate disasters multiplied a hundred-fold should the South Pole ever become a goal of rivalry among the nations.

C. WYVILLE THOMSON

NORDENSKJÖLD'S EXPEDITION TO THE JENISSEI[1]

THE expedition, of whose plan, equipment, and composition we have already given some account, left Tromsö in the steamer *Ymer*, on July 25 this year, and on the 30th entered Matotschkin Scharr, where they obtained some specimens of Novaya Zemlya salmon. An easy passage was made to the east side, where, during a stay of twenty-four hours, the naturalists did some collecting, dredging, &c. Leaving the Scharr on the 31st, the Kara Sea was at first found quite open, but after a few hours it became so blocked with loose ice in all directions that the *Ymer* was compelled to turn back, and was anchored on the inner side of the promontory which projects from the southern side of the sound, nearly half way between the entrance and Gubin Bay.

Here the sea is rich in varying animal forms, the land bleak and poverty-stricken. The mountains for the most part consist of black clay-slates, probably early Silurian, and grey dolomite beds, in which search was made for fossils in vain. On the other hand, the clay-slate is in many places full of quartz veins with numerous cavities, whose crystalline contents gave occasion to the unfortunate Tschirakin's statement that he had found here a block of stone set full with the most brilliant, beautiful, and valuable precious stones, for which, after his death, he was vehemently censured by his chief, Rossmylov, who sought in vain for the supposed treasure.

In one respect this part of Novaya Zemlya is of great geological interest; for here are to be seen no fewer than six clearly-marked beaches, situated at different heights one above the other, and showing that the land hereabouts has been elevated during the very latest geological period at least 500 feet. With the exception of certain parts of Greenland, where a considerable sinking of the land has taken place during recent centuries, a similar raising of the land has been observed in most other Arctic regions, and this raising of the land has without doubt played a very important part in the great geological changes which have occurred on the surface of the earth since the close of the Tertiary period. For the Swedish observer the phenomenon besides has quite a special interest, inasmuch as attention was first called to it in Sweden more than a century ago, and it then gave occasion to an impassioned discussion between those holding different opinions, which is well known in the history of science.

Matotschkin is surrounded by high, bold mountain ridges and summits, which continue to occupy the interior of the island for more than thirty English miles south of the sound. Farther south the mountain tops disappear completely from the interior, and the land passes into a level high-lying plain, nearly free of snow during summer and sloping gently towards the east coast and the Kara Gate, till it terminates most frequently with a precipitous face towards the sea.

A broad ice-free belt of water having in the meantime been formed along the east coast of Novaya Zemlya, the expedition took advantage of it, and sailed along shore. The greater part of the ice-fields were, however, now quite rotten, and it was clear that they would completely melt away during the remaining part of the summer.

Partly by ice, partly by fog, the *Ymer* was prevented making right across the sea, and it was not till the 12th that the ice-belt was so broken up that they could steam on round White Island, past the Gulf of Obi to the mouth of the Jenissei.

We sighted land here on the 15th, Dr. Nordenskjöld goes on to state, thus exactly a year after the rocks at Dickson's Harbour were first seen from the *Prören*. This was some hours sooner than the dead reckoning promised, which at first was ascribed to the influence of an easterly current in the parts of the Kara Sea we had just traversed. When we came nearer, however, I was surprised to see before me a plain which was unbroken by any "berg-åsar," though I knew, from last year's observation, that

[1] Abstract of Prof. Nordenskjöld's Report in the *Göteborgs Handels Tidning*, October 24.

an "ås," which was certainly low, but yet perfectly developed, runs over the tundra towards Jewremow Kamen; neither could we discover any of the rocky islands which surround Dickson's Harbour. In the meantime we continued our course up the river along the bank, and after the lapse of four or five hours we obtained a quite unexpected explanation of the circumstances described. For it appeared that the mouth of Jenissei, which is ten Swedish miles (60′) wide, is divided into two by an island about five Swedish miles (30′) long, which was thought to have been unknown both to Russian chartographers and to the natives. That it has not been before observed clearly depends on its not being visible from the river bank along which the few boats that have traversed this part of the river are believed to have always kept. The navigable water on both sides is deep and free from shallows. This large new island ought clearly to be advantageous for navigation in those regions, as it will form a welcome protection against north-westerly winds and sea for the vessels that may be in the mouth of the river. I mean to name it Sibiriakoff's Island, after the zealous and generous supporter of all this year's Siberian expeditions.

Steaming up the river the *Ymer* reached Mesenkin, which had been appointed the meeting-place with Dr. Théel's party. Here, where the Mesenkin falls into the Jenissei, Dr. Théel expected to obtain some specimens of mammoth skins, which, it was reported, had been washed out of the tundra near this place. Dr. Théel's party, not, however, having arrived at Mesenkin when the *Ymer* reached it, Nordenskjöld himself made an excursion to the locality already spoken of, where the mammoth hide was found. No complete hide was found here, but he succeeded in digging two large and a number of small pieces out of a newly-formed sand-bank at the confluence of the Mesenkin with the Jenissei. The excavations showed that the mammoth remains in question had been newly brought down by the spring floods to the place where they were found from some point situated higher up in the river valley of the Mesenkin, and that the place where the mammoth was originally imbedded in the frozen tundra is to be sought for in this direction.

On August 17 the *Ymer* proceeded up the river, but the water became so shallow, and the navigation by a steamer of such draught as the *Ymer* so dangerous, that Dr. Nordenskjöld resolved to return to Mesenkin. He left his merchandise at Korepowskoj simovie, near Mesenkin, to be taken away next summer by the river steamer. After landing the goods another vain attempt was made to steam up the river, and the *Ymer* was again anchored, this time between Orlowskoj and Gostinoj. The following days were devoted to excursions which yielded interesting information regarding the geology of the tundra, and a very rich collection of the sub-fossil shells, which are found in the sand of the tundra.

By the word *tundra* are denoted, as is well known, the plains of immense extent in Russia and Siberia lying between the boundary of the forest region and the Polar Sea. The ground, at least in the northern parts of the Siberian tundra, is continually frozen at no great depth, but during the summer bears a vegetation of low bushes, mosses, and grass, which yields summer pasture to numerous herds of reindeer, partly wild, partly tame, which wander about on them.

To the eastward of the Jenissei the tundra forms a level or slightly rolling plain, which toward the river has a sloping bank 50 to 100 feet high. In the interior of the country the plain is not interrupted by any very considerable heights, but on the other hand it is intersected at a number of places by deep river valleys, whose steep sides offer fine sections of the earthy layers. It is apparent, on a merely cursory examination, that these for the most part consist of enormous masses of sand and mud washed down by the Siberian rivers. The tundra, however, is by no means a common delta formation. Numerous marine shells imbedded in the sand show that the tundra plain formerly lay under the surface of the sea, and that therefore a considerable elevation of the land must have taken place during the latest geological period. For all the shells imbedded in the tundra sand belong to existing types, the most of which have been dredged up by us from the bottom of the Kara Sea, and which we again find in the post-glacial beds at Uddevalla and Christiana Fjord, and the crag formation of England. All this shows that the tundra has been formed under climatic circumstances very similar to the present, which is further confirmed by the geognostic formation of the beds. It has therefore long been difficult of explanation by the geologist that just in these sand-beds there are found in great abundance remains of the mammoth, rhinoceros, &c., that is to say, of animal types that for the present flourish only in a tropical or sub-tropical climate.[1] The evident contradiction which is apparent here has indeed obtained an explanation through the researches of the Petersburg academicians, Middendorff, Schmidt, and Brandt. But there remains here much to clear up, and collections from these regions have, besides, a peculiar interest, from the remarkable circumstance that here in the frozen earth of the tundra there are found not only skeletons, but also flesh, hides, hair, and intestines of animal types which died out many hundred thousand years ago. I therefore, Dr. Nordenskjöld goes on to say, of course, gladly availed myself of the opportunities which offered themselves in making excursions in the neighbourhood of the places where the vessel was anchored. Among the results of our search may be mentioned large pieces of mammoth hide, found along with some few pieces of bone, at the confluence of Mesenkin with the Jenissei; a skull of the musk ox, remarkable for its size, found together with mammoth bones in another tundra valley south of Orlowskoj; a very rich collection of sub-fossil shells, found principally between Orlowskoj and Gostinoj. In addition, various interesting observations concerning the geological formation of the tundra, &c., were made.

During their stay on the Jenissei there was often a dense mist with rain prevailing, but otherwise they were favoured, as a table of observations shows, with warm and summer-like weather. The ground was quite free of snow, and at several places, especially in the tundra valleys, adorned with a variegated carpet of flowers. According to the statement of the inhabitants, however, the former part of the summer in these regions had not been fine, and the preceding winter had been exceedingly severe. The temperature of the water of the river at the surface was almost constantly + 12° to 13° C., and even at a depth of nine fathoms the deep-water thermometer marked + 11·1° C.

As it had been arranged that Théel's party, which, as our readers know, had come overland, should in no case stay so long on the northern part of the Jenissei as to run the risk of missing the last river steamer to Jenisseisk, which this year was to leave Saostrowskoj about September 7, Nordenskjöld resolved to set out on the return journey on September 1. This he did, as Théel's party had not turned up.

The sea, he continues, was at first completely free of ice, and first when we came quite close to the east coast of Novaya Zemlya in 75½° N. lat., a very compact belt of worn ice was fallen in with, which stretched along the coast towards Matotschkin. The course was now set along the ice towards the south to 74° 40′ N. lat., where the edge of the ice took a westerly direction, which allowed us, without the inconvenience of being hindered by ice, to steam right westwards towards Matotschkin. A perceptible swell now gave indication of ice-free water. If the course from Dickson's Harbour had been set close past White Island towards Matotschkin we certainly would not have met with a single ice-floe. Even in the northerly way I chose our advance was scarcely hindered by ice but by a nearly constant fog, which compelled us to lie still at night. In this way Dr. Stuxberg, the zoologist of the expedition, obtained a welcome opportunity for dredging and swabbing in the deep channel along the east coast of Novaya Zemlya.

Of all the expeditions which have gone to Novaya Zemlya and the sea surrounding it, there are only three which, before the last two Swedish ones, concerned themselves with zoological, botanical, and geological researches and the collections pertaining to them. These are von Baer's expedition in 1837, Heuglin's in 1871, and the Austro-Hungarian in 1872-74.

As far as zoology is concerned, von Baer brought home from his journey about seventy species of invertebrate animals, Heuglin increased our knowledge of the number of species within some groups, and the Austro-Hungarian expedition within others. But all those collections were from the south-western, western, and northern coasts of Novaya Zemlya. Of the nature of the animal life in the Kara Sea all actual knowledge was wanting till last summer. There was also a current tradition among zoologists, grounded on the knowledge of the immense mass of fresh water which the Obi and the Jenissei yearly carry down, partly also on something at first loosely uttered in literature, which afterwards took the form of axiomatic certainty, that the Kara Sea is exceedingly poor in animals.

The Swedish expedition of 1875 has already dissipated these misconceptions, having brought home from Novaya Zemlya and

[1] The mammoth, for instance, is looked upon as the progenitor of the now living Indian elephant, but a progenitor considerably larger than his descendant, and provided with an abundant covering of hair.

the west coast of Waygats Island a collection many times richer in species than its predecessors. But in any case it was impossible that the collections which were made during a single summer could be taken as giving so complete an idea of animal life in these regions, as is necessary not only for comparison with the existing fauna of other arctic countries, but also for a complete clearing up of its relation to the fauna in the deposits of the Siberian tundra. It was on this account that I made provision for Dr. Stuxberg accompanying this summer's expedition to Jenissej, and carrying on the zoological work. His researches were rewarded with great success, as appears from the short sketch annexed, communicated by him :—

"During the voyages of 1875 and 1876 to Jenissei and back dredging has been carried on at fifty places in all and at different depths from the beach to a depth of 200 fathoms, and rich and comprehensive animal collections have thus been made. A large proportion of species occur locally, and in quite incredible numbers. Others again are found nearly at every dredging, but in far smaller numbers. The occurrence of the latter is more uniform, consequently distinctive of the territory of the fauna in its entirety. To these belong first of all two species of the genus Idothea (*Id. sabinei* and *Id. entomon*), both well-developed, and it may with reason be said that this genus is characteristic of the Kara Sea ; it is the province of the Idotheæ. To the animal forms again which are local in their occurrence belong various species of Mollusca, Hydromedusæ, and Bryozoa, but chiefly all the representatives of the Echinodermata are known to exist here. The abundance of these is sometimes quite surprising, and, what is more singular, where a species occurs in any great quantity, it lives nearly alone, and to the exclusion of all others. This, for instance, is the case with species of the genera Cribella, Stichaster, Ctenodiscus, &c., which here are found in large and well-developed types. Not seldom the swab brought up at the same time hundreds of the same species. Of the beautiful Crinoid *Alecto Eschrichtii* there were obtained many choice specimens.

"But rich as is the Kara Sea in asterids and ophiurids, it is proportionately poor in echini. These have been sought for everywhere without success, except possibly close to the east coast of Novaya Zemlya. This circumstance is the more extraordinary as along the whole of the west coast a species of the family Echinus is one of the animal forms that are most abundant and occur most frequently.

"In two respects the zoological work of this summer has been exceedingly profitable for our museums. It has in the first place added something new in all the groups to the very rich collections made during last summer ; it has, for instance, increased the collection of crustacea by 20 per cent. new species, and of echinodermata a large number of types has by oft-repeated swabbing been obtained in an extraordinary collection of specimens. Further, the swab has brought up from the bottom of the Kara Sea two animals specially remarkable and important in a systematic respect. The first was brought up by the swab during last year's expedition, not far from the eastern mouth of Matotschkin Scharr. Then it was found in only a few specimens, now we have collected a considerable number. It is a hitherto unknown holothurioid, differing greatly from most others of the same group by its quite complete bilateral symmetry, but from all by its habitus and anatomical structure, and being singular in its kind inasmuch as it combines characters from diverse classes of animals. It has lately been exhaustively described and delineated in detail by its first discoverer, Dr. Théel. The other remarkable animal is one of the greatest rarities within the animal world. It is an Umbellularia [1] of about a foot and a half in length. It was found in 150 fathoms south of Cape Middendorff, and north of the 75th degree of N. lat.

"From the collections made during the Swedish expeditions it appears that the Kara Sea, far from being so poor as has been supposed, is, on the contrary, distinguished by an animal life rich both in individuals and in types when compared with that which Spitzbergen, Greenland, Iceland, and the Arctic regions of North America have to show. It appears, also, that a nearly uniform marine fauna is found around the pole along the whole coast of Siberia and the polar archipelago of North America. The immense mass of fresh-water which the great rivers of Siberia carry down, does not in any degree determine the composition of the animal life on the bottom of its Arctic Ocean.

"Before the various groups have been worked out by specialists it is difficult to state for certain the number of the lower animal types of the Kara Sea, but it may be put approximately at nearly 500 species, a considerable number, indeed, for a sea that previously was believed to be as poor in species as the Baltic. Such, with the addition of about a hundred species of insects from Novaya Zemlya, whence previously only seven were known, and an extended knowledge of the vertebrate world, is the main zoological result of the researches of the last two Swedish expeditions in these regions."

The *Ymer* made a safe return voyage through Matotschkin Scharr, and on September 18 anchored at Hammerfest. Dr. Nordenskjöld concludes :—

"My stay at Hammerfest and Tromsö I turned to account in collecting information from the numerous walrus-hunters there about the state of the ice in the Arctic regions, and especially in the Kara Sea. I have succeeded in this way in bringing together very abundant materials for a solution, founded on actual observations, of the problem in navigation which lies before us here, and I shall, by and by, make a full statement of the conclusions at which I have thus arrived. Here I will only say that it is my conviction, which is also shared by the walrus-hunters whom I have consulted, that a regular sea-communication between Siberia and Northern Europe during a short season of the year ought not to be attended with greater risks and dangers than seamen encounter on many other waters now yearly visited by thousands of vessels."

[1] Two specimens of the family Umbellularia, the first of which we have any knowledge, are said to have been found on the coast of Greenland before the middle of last century. After a description first given by Ellis and Mylius, the animal was registered by Linnæus in his "Systema Naturæ," in the year 1758, under the name *Isis encrinus*. What has become of the original specimen is unknown. The enigmatical animal type, as it appeared from the descriptions, has been the subject of many interpretations, till Dr. J. Lindahl, during the Swedish expedition to Greenland in 1871, succeeded in dredging up two specimens of it in Baffin's Bay, and accurately described its interior structure in the *Transactions* of the Academy of Sciences. Individuals of the same genus have since been found, first by the English *Challenger* Expedition in 1873, between Portugal and Madeira, by the same expedition between Prince Edward's Island and Kerguelen's Land, and possibly at other places in the Antarctic Ocean ; afterwards by the Austro-Hungarian expedition in 1873, between Novaya Zemlya and Franz Josef Land (the specimen was lost when the *Tegetthoff* was abandoned) ; again during the present summer by the Norwegian Atlantic expedition off the west coast of Norway, and finally by us in the Kara Sea. It is thus an animal type which is widely distributed, but of extremely rare occurrence.

OUR ASTRONOMICAL COLUMN

TELESCOPIC METEORS.—In his "Histoire de l'Astronomie pour l'Année VIII.," Lalande, referring to Schröter's observations, states, "il a vu plusieurs fois dans son telescope des petites étoiles qui filent comme un petit trait de lumière très-faible, qui dure 2 ou 3^s," and by way of explanation goes on to say that this proves the extension of hydrogen and oxygen many leagues in the depth of the atmosphere ; meteors or globes of fire which excite astonishment when they are a distance of some hundred *toises*, become shooting stars when they are distant a league, and telescopic stars at three or four leagues, an opinion hardly favoured by later research.

When occupied in comet-sweeping, or general observation in a darkand pretty large field, it has very often occurred to the writer to meet with objects of the class mentioned by Lalande. A striking instance was afforded one very fine April morning about twenty-seven years since (the exact date, though upon record is not at hand at this moment), when a number of telescopic meteors as bright as stars of the eleventh magnitude passed slowly through the field at intervals of a minute or more, the instrument during the time of observation being directed to different parts of the constellation Sagittarius and lower region of Ophiuchus ; the course of these meteors was nearly uniform. Their motion was generally so slow that when caught they could be followed to extinction on moving the instrument. On other occasions he had noticed similar slow-moving meteors, though in less number, and hence was under the impression that there was nothing unusual in the occurrence. But in the summer of 1850, happening to mention the observations of frequent faint slow-moving telescopic meteors to Sir John Herschel, that eminent observer, notwithstanding his long experience in both

hemispheres, expressed surprise at the phenomenon, and stated that he did not recollect to have remarked anything of the kind. In 1852 Schmidt published the results of his observations of telescopic meteors between 1844–51, "Resultate aus zehnjahrigen Beobachtungen über Sternschnuppen," p. 165; most of those seen by him were as bright as stars of between the eighth and tenth magnitudes, and generally moved very slowly. Schmidt during these observations was for the most part using a "comet-seeker," the same with which he formed the chart for Hour V. of R.A. in the Berlin series; the writer was invariably observing with the comet-eyepiece on a 7-inch refractor giving a power of about 45.

Perhaps some of the astronomical readers of NATURE may be able to put upon record the dates of other appearances of telescopic meteors in some numbers and with a general uniformity of direction.

Lalande appears to make his reference to Schröter's observation of telescopic meteors with the intention of illustrating the acuteness of vision of the Lilienthal astronomer. Indeed, in the preceding sentence he makes the following extraordinary statement with regard to Schröter :—"Il a une vue privilegiée pour l'astronomie; il voit Mercure en plein jour à la vue simple."

THE COMET OF THE BAYEUX TAPESTRY.—There can now remain very little doubt that the grand comet which astonished Europe in the year of the Norman Conquest leading to a multitude of records in the annals of the time, and forming, with its astonished beholders, the subject of embroidery on the celebrated Bayeux tapestry, was the famous body which now bears universally the name of our countryman Halley. Allowing for the peculiar character of Chinese observations of comets, the account they have left us of its track amongst the stars from the beginning of April to the end of the first week in June, 1066, is well represented by elements not differing more from the actual elements of Halley's comet than accumulated effect of perturbation in eight centuries may well explain. If it is assumed that Halley's comet arrived at its least distance from the sun on March 18, its position when discovered by the Chinese in the morning sky on April 2, would be as they record in their sidereal division "Shih," two degrees south of the equator, and distant from the earth rather less than eight-tenths of the earth's mean distance from the sun. Between this date and June 8, or sixty-seven days after discovery, which is the duration of visibility assigned, the comet would make a grand sweep across the sky from the constellation Pegasus into Sextans between Leo and Hydra, or as the Chinese express it, "through fourteen sidereal divisions from Shih to Chang." The imposing aspect of the comet described in European chronicles and confirmed by the Chinese Annals, wherein it is compared in brilliancy to Venus, and by exaggeration, no doubt, even to the moon, is fully explained by the circumstances under which Halley's comet must have been observed if in perihelion on March 18. When last seen in China it had receded to 1¾ times the earth's distance from the sun.

METEOROLOGICAL NOTES

RECENT STORMS.—We have already referred to the great cyclone of October 31, which will long be remembered as one of the most appalling catastrophes that has occurred in the history of the human race. The storm-wave advanced over Chittagong from south to north, but most of the damage was done along the shores of the Meghna by a storm-wave which swept seawards from north to south. The details of this and the other features of this great cyclone will be looked forward to with intense interest.—We have also given some account of the storm of wind of almost unexampled violence which broke over Sydney at 9.50 P.M. of Sunday, September 10, and continued with unabated fury during the whole of Monday. Since as there are good reasons for the belief that the maximum velocity or force of the wind in great storms is frequently understated, it is desirable that the fullest details of the observations from which the velocity of the wind at the rate of 153 miles an hour has been deduced be published in the monthly publication of the Observatory.—A hurricane of great severity and followed by most disastrous results swept over Central America on October 3 and 4. The town of Managua, on the south side of the lake of the same name, and west of Lake Nicaragua, was inundated on the 4th, and 400 houses were blown down by the hurricane. As the flood rose the inhabitants had to betake themselves to the tops of the houses, and many were drowned by the houses falling. The hurricane then passed eastward over Lake Nicaragua and descended over Blewfield, situated on the Mosquito Gulf, and overturned upwards of 300 houses in that town. It was in all probability the same cyclone which was encountered at the same date by the Panama Transit and Pacific Mail Steamer *Costa Rica* about 300 miles to the south-east, near Parita, on the Gulf of Panama, where it was accompanied with a frightful sea-running wind shifting all round the compass and blowing with such a force that the *Costa Rica* had its hurricane deck blown away and the head of the mainmast, maintopmast, and gaff carried off. Later, or from October 17 to 21, Capt. Bremner, of the steamship *Chilian*, reports the severest hurricane he ever experienced at Cayman's Island, to the west of Jamaica, where 170 houses were destroyed and much damage done to fruit trees and other crops.—The list of heavy storms and hurricanes might be increased by including the severe storms reported as having recently occurred in Behring's Strait, wrecking a dozen of whalers, the great gale near Chefoo, in which H.M.S. *Lapwing* was lost, the terrible storms in Madeira and Portugal, commencing on November 11, and the storms of the British Islands a fortnight since, as well as during the present week, with their attendant floods, which in certain districts attained to a height and a destructiveness unknown for many years. The last two months have thus been noteworthy for the violence of the storms of wind which have been let loose, as it were, over all quarters of the globe, thus offering in their salient weather characteristics a marked contrast to the characteristics of the weather little more than a year ago, when we were called to record disastrous inundations occurring in almost all parts of the globe. During the past two months the weather has not only been characterised by the extreme violence of the wind but also by equally unprecedented and violent alternations of abnormally warm and cold, and dry and wet tracks of weather—the connection between which is no doubt a more deeply rooted one than that of mere coincidence.

METEOROLOGICAL OBSERVATORY ON MONTE CAVO.—We are interested to learn, from a letter which appears in *Comptes Rendus*, that P. Secchi has succeeded in establishing a meteorological observatory on the summit of Monte Cavo. This is the highest of the volcanic group in Latium. Its summit rises 953 metres above the sea-level and about 900 metres above the Roman Campagna. The meteorological instruments are placed in the convent, and the monks are charged to make observations. These instruments are a Fortin barometer, a psychrometric thermometer, a maximum and minimum thermometrograph, a pluviometer, and a weather vane. An anemometrograph will soon be added. The isolation of the mountain, which rises about 200 metres above the surrounding volcanic cones, renders it peculiarly well suited for researches in meteorology. In view of the importance of the institution the Government has agreed to defray the expense of installation. The observations are only begun two months; they show, among other things, that the temperature of Monte Cavo is often higher than that of Rome, and that the variations of temperature are less than on the plain. There is another observatory at the base of the cone, at Grotta-Ferrata, in a monastery there also; its elevation is about 330 metres, and it

serves for investigating the phenomena of the agricultural region, the most interesting of the environs of Rome, along with another station placed at Velletri, on the other side of the volcanic group.

BIOLOGICAL NOTES

THE PRIMARY ELEMENTS OF THE SKULL.—At a recent meeting of the Cambridge Philosophical Society Mr. Bettany brought forward some of the ideas resulting from Prof. Parker's most recent researches, which will be embodied in a forthcoming work on the "Morphology of the Skull," by Messrs. Parker and Bettany. A fundamental point in researches of this kind appears to be the question what are axial and appendicular elements in the skull. For some years past Profs. Huxley and Parker have regarded the primary rods or *trabeculæ* occupying the base of the forepart of the skull as being the foremost of the series of facial or visceral arches (mandibular, branchial, and the like). In several types, although these *trabeculæ* lie in the true base of the cranium, they are at an early stage more or less parallel with the visceral arches; and certain nerve-relations appeared to show a close similarity between them. But Mr. Parker now believes their facial nature cannot be maintained. They arise in tissue immediately beneath the brain cavity as the vertebræ arise beneath the spinal canal; the temporary flexure of the fore-part of the skull does not make this tissue other than axial. Every relation of the trabeculæ proper is to the nervous centres, and cartilaginous growths continuous with them bound the cranium laterally just like the lateral occipital or vertebral regions. Mr. Bettany also directed attention to the nasal, prenasal, and antorbital regions of the skull as probably showing rudiments of true appendicular parts in the anterior regions of the head. In the discussion which followed, Prof. Humphry cordially welcomed this rehabilitation of the trabeculæ, having never been able to agree with Prof. Huxley that they were facial in their origin. He could not doubt that the bones formed in them, the basisphenoid and presphenoid, were axial in character. He thought that further research would but demonstrate more clearly the vertebral or segmental theory of the skull.—Mr. Balfour thought research was not yet sufficiently advanced for a true estimate of the skull to be formed. Although the trabeculæ might be morphological continuations of the basal cartilages in the hinder part of the skull, yet the greater part of the vertebræ and part of the base of the skull, arose from an unpaired cartilaginous mass surrounding the notochord, while no such element existed in the anterior part of the skull. It appeared very possible that the lateral parts of the cranial floor behind were really equivalent to the base of the cartilages which formed the vertebral arches, and thus the trabeculæ might similarly be regarded as only the basal parts of the continuous lateral wall of the skull.

THE ANATOMY OF THE GORILLA.—Dr. H. Bolau, director of the Zoological Gardens at Hamburg, has recently had the fortunate opportunity of dissecting three gorillas preserved in spirit, with the viscera intact. His results are just published in the "Abhandlungen aus dem Gebiete der Naturwissenschaften," and they add much to our zoological information. The brain is figured by photography from three aspects, Dr. Ad. Pausch describing the convolutions. In all the specimens the liver exhibited the lateral fissures or incisions which are not found in man, the orang, the chimpanzee, or the gibbon, but in all the lower monkeys. This agrees with the descriptions given by Professors Huxley and Flower of the specimen in the Museum of the College of Surgeons; and serves to separate off the gorilla from the rest of the anthropoid apes. The caudate lobe is minute, and the spigelian lobelet of fair size. As in man only among the primates, valvulæ conniventes, the transverse folds of the mucous membrane of the small intestine, so large in the Sumatran rhinoceros, are present, although they are not large. We hope to be able to enter more fully into the results arrived at by Dr. Bolau next week.

THE WINDPIPE IN MANUCODIA.—For a long time it has been known that in the Paradise Bird, *Manucodia*, the windpipe, instead of running straight from the neck into the chest, takes a turn forming a spiral over the front of the breast under the skin before it divides to enter the lungs. M. P. Pavesi has just read an interesting paper on the subject, published in the *Annali del Mus. Civ. di St. Nat. di Genova*, in which he shows that in the three species of the genus examined by him this superficial spiral is only developed in the adult *M. keraudrenii*, in the female of which an irregular and crooked loop only exists; whilst in *M. chalybea* it is only in the male that any superficial loop is found, this being straight and longitudinal, like that in many of the Guans and Curassows of South America. In *M. atra* there is no loop in either sex. M. Pavesi also demonstrates that different specimens of the same species differ slightly in detail.

NOTES

WE announce with sincere regret the death, on Tuesday morning, from malarial fever, of Mr. David Forbes, F.R.S., the well-known Foreign Secretary of the Iron and Steel Institute. Mr. Forbes was only forty-nine years of age. We hope to give a memoir next week.

WE regret to announce the death of Mr. Louis A. Lucas, the African traveller, at the early age of twenty-five. He reached the equatorial provinces in the month of June last, but his escort proving too weak to allow him to penetrate further into the interior, he returned to Khartoum, *en route* for Suez, intending to reorganise his expedition, and proceed by way of Zanzibar to the Congo. After repeated attacks of fever, he left Khartoum on October 26, but died on the Red Sea, near Jeddah, on his way back, having abandoned all idea of further exploration.

CAPT. NARES has been made a K.C.B. There can only be one opinion that by his conduct both of the *Challenger* and Arctic Expedition he has well earned such an honour. The *Alert* and *Discovery* have been paid off, and the crews were entertained at the Mansion House on Tuesday evening.

COL. GORDON has arrived in Cairo, after an absence in equatorial Africa of three years.

A NAIRNSHIRE African Association has been formed in connection with the International African Association instituted by the King of Belgium.

THE just published *Cosmos* of Guido Cora is mainly devoted to Africa. One paper describes the explorations of Antinori, Beccari, and Issel in the region of the Red Sea about the Straits of Babelmandeb, and another contains letters from various members of the Italian Expedition to Equatorial Africa. There is also an address on Italian Travellers in Africa, by Signor F. Bonola, given to the Egyptian Geographical Society.

ACCORDING to Behm and Wagner's just published Yearly Review of the Population of the Earth, the total population of the globe amounts to 1,423,917,000. Of this number Europe claims 309,178,300; Asia, 824,548,500; Africa, 199,921,600; Australia and Polynesia, 4,748,600; and America, 85,519,800. The average density of population of the whole globe is about 28 inhabitants to one square mile of land surface. The density is of course greatest in Europe, where it is 82 per square mile; in Asia, 48; in Africa, 18; in America, 5½; and in Australia and Polynesia, about 1½. The publication is accompanied by two maps, one showing density of population in India, and the other recent changes in the boundaries of various districts and countries.

MR. A'COURT SMITH writes to us from Gurnet Bay that he has recently found two celts about a mile to the westward of the one referred to in NATURE, vol. xi. p. 466. They are both of dark flint, one is very rough, and though apparently used, seems unfinished. The other is curved, and chipped very evenly, the flat surface still showing the weathering of the old flint.

WE are glad to see that the North of England Institute of Mining Engineers has at last been incorporated by Royal Charter. This institute was founded in 1852, and has done good work in its own important department.

MR. HERBERT SPENCER'S new volume, the sixth of the Synthetic Philosophy, comprising the first of his "Principles of Sociology," is now ready and in the hands of the binder.

IT is intended to issue from the press of the University of Dublin a series of works, chiefly educational, by members of that University. It is expected that the earliest volumes of the series will be the following:—"Lectures on Physical Geography," by Rev. Samuel Haughton, M.D., F.R.S., Professor of Geology; a treatise on "The Morphology of the Vertebrate Animals," by Alexander Macalister, M.D., Professor of Zoology and Comparative Anatomy; and the first portion of a complete edition of the "Letters of Cicero," with a Commentary, by Robert Y. Tyrrel, A.M., Professor of Latin.

A BELGIAN Geographical Society has been established, with M. Liagre as president. Judging from its rules, it is founded on a comprehensive basis, and is likely to do good work. It will publish a journal.

A NEW Geographical Society has been founded in Denmark. The Society proposes to organise lectures, and has invited Prof. Nordenskjöld to speak on the Kara Sea and Jenissei, and Prof. Bergrren on New Zealand, where he stayed during a number of years. The Society will issue a geographical magazine.

THE deep boring at Rheinfelden, on the Swiss shore of the Rhine, as seen from a report of Prof. Desor, was stopped at a depth of 1,422 feet, after having pierced 200 feet of granite and diorite, and without meeting with the coal-measures which were expected. It was carried out on the system which has already proved successful in the 2,200-feet boring in Bohemia, *i.e.*, by the process of cutting out of the rock a cylinder by means of a diamond crown. The diameter of the bore, which was, until a depth of 660 feet, only 5 centimetres, was afterwards enlarged to 12, being thus the largest diameter used until now in this kind of boring. In a more or less coarse sandstone the boring advanced at an average rate of 15 metres (49 feet) in twelve hours, and proved altogether most successful. A complete collection of cylinders, cut out of the rocks pierced, which are mostly dyas, is now deposited at the Museum of Aarau.

MESSRS. BICKERS AND SON have just published a new edition of Mr. J. E. Harting's "White's Selborne," containing in an appendix the ten letters from Gilbert White to Robert Marsham which first appeared, with notes by Mr. Harting, in the *Transactions* of the Norfolk and Norwich Naturalists' Society. A detailed notice of these letters will be found in NATURE, vol. xii. p. 481. They possess great interest, and add materially to the value of Mr. Harting's beautiful edition of "The Natural History and Antiquities of Selborne."

MR. R. E. BARTLETT, of Chelmsford, has sent us an interesting relic of Mr. Robert Marsham, F.R.S., a well-known observer and recorder of natural phenomena of last century. It is a table containing indications of spring, observed by Marsham at Stratton, Norfolk, read before the Royal Society in 1789. The indications consist of observations on birds, insects, flowers, trees, &c., as to the times when first they appeared, or sang, or leafed, &c. The observations extend over from thirty to sixty years, and are neatly and clearly arranged.

A BED of pink coral has been discovered by the captain of the U.S. steamer, *Gettysburg*, on her passage from Fayal to Gibraltar, in lat. 36° 30' N., long. 11° 38' W. The least depth found was 30 fathoms, but the captain has no doubt that the coral comes to the surface at some point near the anchorage. Twenty miles west of the bank a depth of 16,500 feet was found. Between this and Cape St. Vincent, 12,000 feet. The bank is rich in valuable coral of light pink shades. Full details of the discovery have been sent by the commander of the *Gettysburg* to the Navy Department, Washington, by mail.

TELEGRAMS have been received from Bahia (Brazil) stating that the *Frigorifique* had crossed the Atlantic successfully with the methylic ether refrigerating apparatus, which worked admirably through the torrid climate of the equator, meat brought from Europe having been found excellent by the Brazilians. More details are sent by letter.

THE French scientific papers publish a letter signed by MM. Jacquet, Hovelacque, Mortillet, and others, engaging to give by will their brain, or any part of their body, to the laboratory of the Anthropological Society, so that experiments may be made and useful observations collected. A special club or society has been established for that purpose.

WE have received a highly satisfactory Report for 1875-6, of the Dundee Free Library, perhaps one of the best managed institutions of the kind in the kingdom, thanks to its able librarian and curator, Mr. Maclauchlan. An unusually large proportion of the books consulted and lent were scientific, a decided increase being attributed to the University Science Classes in connection with St. Andrews University. In connection with the library a fine museum is being gradually collected, Arctic fauna and flora, as might be expected, being largely represented. We have also received the Twentieth Annual Report on the Sheffield Free Public Libraries and Museum. The libraries are evidently largely taken advantage of, and a very large proportion of the books in demand belong to the department of Arts and Sciences. The Sheffield Museum, which was established some twelve months ago as a Free Public Museum, has lately received the very fine collection of antiquities known as the Bateman Collection, formed by the late William and Thomas Bateman of Derbyshire, and previously stored in Lomberdale House, near Bakewell, where it was almost entirely hidden away, and known by little more than the printed catalogue of it compiled by Mr. Thomas Bateman, and published in 1855. The collection consists chiefly of British antiquities ranging from the Celtic to the Old English period, and is especially rich in Celtic and Roman remains. It also contains many Etruscan, Greek, and Egyptian antiquities of considerable rarity and interest. The public of Sheffield and lovers of antiquities generally, are indebted to Mr. W. T. Bateman of Middleton Hall, Derbyshire, for the opportunity of inspecting and studying this interesting and instructive collection.

AT the meeting of the Mathematical Society of November 9 Prof. Smith was chairman only in the early part of the meeting; before the reading of the papers, the new president, Lord Rayleigh, took the chair.

THE distribution of prizes and certificates obtained by the students of the Science and Art Classes of the Belfast Working Men's Institutes took place on November 28. These classes are attended by hundreds of persons of the very kind to whom they are likely to do most good, and yearly carry off a large percentage of the prizes of the department. Dr. Andrews distributed the prizes and gave a short address.

THE inauguration of the French National School of Agriculture took place at the Conservatoire des Arts et Métiers on Wednesday, December 6. There are about fifty pupils, all f

them taking the course of lectures for the first year of instruction. Amphitheatres and classrooms have been prepared for them in one of the courts of the establishment.

AT a recent meeting of the United States National Academy, Prof. Henry communicated some additional facts obtained in his long-continued and elaborate researches concerning sound in relation to fog-signals. His principal investigation this year had reference to the divergence of sound, especially as to the phenomenon known as the Ocean Echo. To test the explanation given by Prof. Tyndall, requiring reflection from the air, the trumpet of a siren was turned directly to the zenith. The blast was exceedingly intense, but no echo was heard from the prolongation of the axis of the trumpet, *i.e.*, from the zenith. A loud echo was, however, heard from the whole circumference of the horizon, half of which was on land, the other half on water. This was repeated many times, and always with the same result. In one case a small cloud passed directly across the zenith, from which a few drops of rain fell into the mouth of the trumpet; still no sound was heard from the zenith, although sound continued to be heard from around the horizon. In this case, on account of the divergence of sound, portions of waves in every direction must have descended to the horizon; and as some of these must have reached the plane of the ocean in a path curving inward towards the source of sound, they would, when they reached the ear of the observer in the vicinity of the source, seem as if coming from a point in the horizon, and hence would give rise to the phenomenon of the ocean echo. Rays of sound at different distances from the ear would be reflected from the surface of the ocean, and thus give rise to a prolonged echo. This is in accordance with the fact observed during last summer, that a blast of five seconds' duration gave an echo that was prolonged twenty seconds. That could only be produced by ordinary reflection from a series of surfaces placed at different distances, an arrangement of the material of the atmosphere which (on the doctrine of probabilities) would not be of frequent occurrence.

IN an address at the Manchester Literary and Philosophical Society, Prof. Boyd Dawkins made some forcible remarks on the position of museums in Britain. After speaking of the necessity of museums and laboratories to the student of nature, and of the few good museums in this country, he said:—"From my experience of those abroad, I turn to those of our own country with feelings of envy and regret. Here a museum is frequently a large sort of advertising bazaar, or a receptacle for miscellaneous curiosities unfitted for a private house, or it is composed of an accumulation of objects valuable in themselves but valueless for all practical purposes, because they are crowded together, or stowed away for want of room. They are generally undermanned, starved for want of funds, largely dependent on casual benevolence, or a burden on the scant resources of the various societies. On the Continent, in America, and in Australia, they are as a rule well officered, well arranged, and not dependent on private resources for their sustenance. That our museums should be allowed to be such a striking contrast to those of our neighbours and kinsmen is a most singular oversight in the richest, and, as we sometimes fancy ourselves to be, the most practical people in the world. With regard to the arrangement of subordinate parts in a museum, that which is now being carried out in the new Imperial Museum, at Vienna, under Dr. Hochstetter, seems to me the best; to form one lineal series, inorganic objects forming the base, then Palæontological specimens, illustrating the life which has been, and leading up to the illustrations of the life which is now on the earth, Botany, Zoology, Anatomy, and the like. When this is completed, the Museum at Vienna will present a more perfect and complete history of the knowledge of the earth and its inhabitants than has as yet been presented. In the City of Lyons, which in its commercial aspects resembles Manchester, the collections are lodged in a magnificent building—the Palais des Beaux Arts—supported by the municipality, and are being largely increased by the contributions of local naturalists, who have banded themselves together for that purpose under the title of 'Les Amis des Sciences Naturelles.' There is one point in which the British Government may learn a lesson from the German. When I was in Berlin this autumn I had the pleasure of meeting gentlemen who had been sent by the latter to make collections in the Americas, in India, and in the China seas; and I saw a valuable collection made by German cruisers in the Pacific. Why should not our ships of war, which are to be found in every sea, have orders also to bring home collections from distant stations, and why should not we send out travellers with the same object? With our navy and our wandering instincts, we ought rapidly to outstrip any rivals, and that at a comparatively small expenditure of money."

THE Manchester Literary and Philosophical Society possesses a select and valuable library; a catalogue of this, by Mr. Nicholson, hon. librarian, has just been published.

WE have received the winter programmes of five Cumberland Scientific and Literary Societies. They appear to us satisfactory, and creditable to the intelligence and culture of the Cumberland folk. The towns to which these societies belong are Workington, Whitehaven, Maryport, Cockermouth, and Keswick, and in some of them, besides lectures by well-known men, and papers by members, regular science classes are to be held during the winter. These and other societies, as we intimated some time since, are formed with the Cumberland Association for the Advancement of Literature and Science, Part I. of the *Transactions* of which is to hand, and contains some papers worth perusing.

A MAGNIFICENT work on the Yellowstone National Park is about to be published by Prang and Co., Boston, U.S. The description is to be by Prof. Hayden, and will be accompanied by a fine series of chromo-lithographic reproductions of water-colour sketches taken by the artist to the expedition of 1871, Mr. Thos. Morran. The work will be published simultaneously in English, French, and German.

IN 1866 the students at the six Russian Universities—St. Petersburg, Moscow, Kasan, Kharkoff, and Odessa—numbered 3,591; in 1871 they were 5,301; but in 1873–1874 there was a large diminution, and in 1875–1876 they were only 4,492. It appears that, generally speaking, Russian students have no resources of their own, and are obliged to give lessons to support themselves. At Moscow many of them are said to be in a miserable condition, principally amongst medical students. Three or four students lodging in the same miserable room is a usual occurrence. From 1870 to 1873 the University registers show that 3,224 students left, having finished their course of studies, but no less than 2,911 were obliged to desist without having taken their degree. A good many scholarships of the amount of from 19*l.* to 38*l.* yearly (which amount it is proposed now to raise to 45*l.*) were founded by Government, and yet more by private persons and institutions; but the number of them is yet far below the number of students who have no other means of subsistence than miserably paid lessons. After all, the Russian students are not worse off than many of the students at the Scottish Universities. A few years ago at St. Andrews it was no uncommon thing for students to cover all the expenses of a six months' session, including 10*l.* for fees, with from 16*l.* to 20*l.*; they would simply have stared had they been spoken of as miserably off.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus radiatus*) from

India, presented by Mrs. Aspinwall; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. Richard Schott y Larios; a Duyker Bok (*Cephalophus mergens*) from Natal, presented by Mr. J. D. Witherspoon; a Hairy-rumped Agouti (*Dasyprocta prymnolopha*) from South America, presented by Mrs. Booth; a Spring Bok (*Gazella euchore*) from South Africa, purchased; a White-throated Capuchin (*Cebus hypoleucus*) from Central America, three Rough-legged Buzzards (*Archibuteo lagopus*), European, deposited; a Long-nosed Crocodile (*Crocodilus cataphractus*) from West Africa.

SCIENTIFIC SERIALS

Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, vol. xxv. The following papers are published in this volume: On some new species of *Mycetophilidæ* from the neighbourhood of Sandez (Galizia), by Dr. A. Grzegorzek.—On the structure of the muscular cells and on the general structure of *Mnestra parasites*, Krohn, by Prof. C. Claus.—On some new and some insufficiently known species of *Cecidomyidæ* of the Vienna district, by Dr. Franz Löw.—On the relations of the African and Indo-Malayan bird-fauna, with some general remarks on the geographical distribution of mammals, by A. von Pelzeln.—On Hungarian fungi (third treatise: *fungi hypogæi*), by Prof. A. Haszlinsky.—Description of new and insufficiently known *Phryganidæ and Oestridæ*, by Dr. Fr. Brauer.—Mycological notes, by S. Schulzer von Müggenburg.—*Hemiptera Heteroptera Austriaca*, MM. Maji.—Augusti, 1870, a J. A. Palmén collecta, by O. M. Reuter.—On some new *Lepidoptera* of the South American fauna, by Dr. O. Staudinger.—Second note on the Arachnida-order of *Territelariæ* Thorrell (Mygalidæ Autor.), by Dr. Anton Ausserer. This is one of the most elaborate papers in the volume. On North-American moths, specially *micro-lepidoptera*, by Prof. P. C. Zeller; this is equally elaborate.—Notes on Adriatic echinoidæ, by Dr. E. von Marenzeller.—On the vegetation-formations of the Taurian peninsula and its climatic conditions, by Dr. A. Rehmann.—Researches on the *Diptera*-fauna of Austria, by Josef Palm.—On the ornithological fauna of Moravia, by F. von Dalberg.—On the occurrence of *Salix babylonica, L., androgyna et masculina* in Austria, by J. E. Hibsch.—Lichenological excursions in the Tyrol, by F. Arnold.—On some species of *Salix* new in the "Wechsel" district (Lower Austria), by E. Woloszczak.—Researches on land-*Isopoda*, by C. von Vogl.—On some species of *Spermophilus*, by Ernst Schauer.—On the fungi-flora of Bohemia, by F. von Thümen.—On the occurrence of short-eared *Arvicolæ* near Vienna, by Prof. L. H. Jeitteles.—On thermal constants and the power of accommodation in the vegetable kingdom, by Prof. H. Hoffmann.—Remarks on some ferns from the island of Celebes, by M. Kuhn.—Botanical excursions in Italy, by Dr. C. von Marchesetti.—Researches on some parasites infecting the hop plant, producing mildew and "kupferbrand" (copper-burn), by Wilh. Voss.—Second paper, containing additional remarks on the *Cecidomyidæ* of the Vienna district, by Dr. Franz Löw.—Researches on *Æolidiadæ*, by Dr. R. Bergh.—New researches on *Phyllidiadæ*, by the same.—European *Encyrtidæ*, considered biologically and systematically, by Dr. G. Mayr (this paper occupies some hundred pages).—Muscorum species nova, by J. Juratzka.—Symbolæ ad pteridographiam et Characeas Hungariæ præcipue Banatus, by Dr. V. de Borbás.—On some Lepidoptera, by A. F. Rogenhofer.—Researches made upon leaf galls and their causes on *Vitis vinifera*, by G. von Haimhoffen.—Six years' observations on the first appearances both in the animal and vegetable kingdoms at New Cologne near Milwaukee (North America), by Th. A. Bruhin.—On the flora of Lower Austria (second paper), by J. Wiesbaur.

Poggendorff's Annalen der Physik und Chemie, No. 9, 1876.—This contains the following papers:—Experimental researches on liquid-friction in salt solutions, by M. Sprung.—On the summer rain season of Germany, by M. Hellmann.—Observation of the retardation in the progress of the induction current by means of tuning-fork apparatus, by M. v. Ettingshausen.—On the passage of strong induction currents through liquids, by M. Herwig.—Contributions to electrodynamics, by M. Wand.—On the dependence of the electric conductivity of selenium on heat and light; the photography of tones, by M. Stein.—On the dependence of the specific heat of mercury on the temperature, by M. Winkelmann.—An interesting aërostatic experiment, by M. Reauleaux.—On the theory of double refraction, by M. v. Lang.

THE *Naturforscher* for October, 1876, contains the following papers of interest:—On the specific power of substances in solution, to turn the plane of polarisation, by H. Landolt.—On the uneven surface of meteorites, by M. Daubrée.—On the nature of milk globules and the formation of butter, by F. Soxhlet.—On some phenomena in the combustion of gases, by Herr Horstmann.—Note on the germ-leaf theory in botany, by Herr Famintzin.—On the action of carbon bisulphide as a means for conserving animal and vegetable substances, by Phil. Zöller.—On the absorption of carbonic acid by saline solutions, by J. Setschenow.—On the explosion-limits of mixtures of combustible gases with oxygen or atmospheric air, by A. Wagner.—On the first appearance of the plants now living during geological periods, by Herr de Saporta.—On the deep-sea temperatures in the South Pacific and the circulation of waters from ocean to ocean; speculative remarks based upon the results of the *Gazelle* Expedition sent out by the German Government, by Herr von Schleinitz.—On the chemical composition of leaves, according to the age and species of trees, by P. Fliche and L. Grandeau.—Hypothesis on the nature of the soft aggregate state of matter, by L. Pfaundler.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, November 8.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Melville Attwood, San Francisco, and R. W. Moore, Whitehaven, were elected Fellows of the Society.—The following communications were read:—A short notice of a new exposure of rhætics near Nottingham, in a letter from E. Wilson, F.G.S., dated November 3, 1876.—Note on the Red Crag, by W. Whitaker, F.G.S.—On the Kessingland Cliff Section, and the relation of the forest-bed to the Chillesford Clay, with some remarks on the so-called terrestrial surface at the base of the Norwich Crag, by F. W. Harmer, F.G.S.—Observations on the geology of East Anglia, &c., by S. V. Wood, jun., F.G.S., and F. W. Harmer, F.G.S., &c. The subjects discussed in this paper were threefold, viz.:—(1) The unfossiliferous sands of the Red Crag. (2) The unconformity between the Lower and Middle Glacial deposits. (3) The mode in which the Upper and Middle Glacial were accumulated. The views of the authors under the first head were similar to and confirmatory of those advanced in the previous paper by Mr. Whitaker; but they pointed out that the Red Crag, which these sands, in an altered form, represent, could not belong to the Chillesford division of that formation, by reason of the casts of shells which had been preserved not comprising any of the more characteristic Chillesford species, and of their including among them forms confined to the older portions of the Red Crag. They also pointed out that the Chillesford Clay had been removed over all the area occupied by these sands by denudation prior to the deposition of the Middle Glacial, which rests upon these sands wherever they occur. The removal of the Chillesford Clay, the authors consider, was due in part, if not in all, to the great denudation between the Lower and Middle Glacial, which gave rise to the unconformity discussed under the second head. This unconformity they illustrate by lines of section traversing most of the river valleys of Central and East Norfolk and Suffolk. These show that such valleys were excavated after the deposit of the Contorted Drift, and out of that formation and the beds underlying it. They also show that the Middle and Upper Glacial have been bedded into these valleys, as well as spread (the middle only partially, but the upper more uniformly) over the high grounds formed of contorted drift out of which they were excavated, and thus generally concealing that deposit, which manifests itself only in the form of occasional protrusions through these later formations, but which they consider constitutes, though thus concealed, the main mass of the two counties. The authors also describe a glacial bed as occurring at various localities in the bottom of some of these valleys, and which in one case they have traced under the Middle Glacial. This they regard as having been formed in the interval between the denudation of the valleys and their subsequent submergence beneath the Middle Glacial sea; and inasmuch as such valley-bed invariably rests on the chalk in a highly glaciated condition, they attribute its formation more probably than otherwise to the action of glaciers occupying the valleys during an inter-glacial interval of dry land. They also suggest that if this was so it is probable that that the forest and mammaliferous bed

of Kessingland, instead of being coëval with the pre-glacial one of the Cromer coast, may belong to this inter-glacial interval—that is to say, to the earliest part of it, before the glaciers accumulated in the valleys, and when the climate was more temperate, any similar deposits in these inter-glacial valleys having been for the most part subsequently ploughed out by the action of the glaciers. In discussing the subject under the third head the authors point out the many perplexing features which are connected with the position and distribution of the Middle Glacial formation; and while they admit that as to one or two of these the theory which they offer affords no explanation, they suggest that the theory of this formation's origin which best meets the case is as follows, viz.:—As the country became re-submerged, and as the valley glaciers retreated before the advancing sea, the land-ice of the mountain districts of North Britain accumulated and descended into the low grounds, so that by the time East Anglia had become re-submerged to the extent of between 300 and 400 feet, one branch of this ice had reached the borders of the counties of Norfolk, Suffolk, Essex, Herts, and Bedford, ploughing out and destroying any lower glacial beds that had been deposited over the intervening counties upon which it rested, and over which we ought otherwise, having regard to the depth of the earlier submergence under which they were accumulated, to find them, but do not. The Middle Glacial formation, consisting of sand and gravel, they attribute principally to the action of currents washing out and distributing the morainic material, which was extruded on the sea-bottom by this land-ice; that ice itself, by keeping out the sea over all the country on which it rested, which was then below the sea-level, preventing the deposit of the Middle Glacial in those parts. The termination of this current action was accompanied by increased submergence and by a gradual retreat of the land-ice northwards to the mountain districts, until Britain was left in the condition of a snow-capped archipelago, from which eventually the snow disappeared and the land emerged. To the moraine extruded from the base of this ice and into deep water they refer the origin of the Upper Glacial Clay, the moraine material remaining partly in the position in which the ice left it, and partly lifted by the bergs which became detached from the ice. Such part of it as was lifted was dropped over the sea-bottom at no great distance from its point of extrusion, and in that way the marine shells occurring in a seam of sand in the midst of this clay at Dimlington and Bridlington on the Yorkshire coast became imbedded, the mollusca which had established themselves on the surface of this moraine material having been thus smothered under a lifted mass of the same, which was dropped from a berg. The authors point out that precisely in the same way in which the Middle Glacial is found stretching out southwards and eastwards beyond the Upper Glacial Clay in Suffolk and in Herts, and is succeeded by such clay both vertically and horizontally, so does the earlier-formed part of the Upper Glacial Clay, or that with chalk *débris*, stretch southwards beyond the later-formed part, or that destitute of such *débris*, and is succeeded by it, both vertically and horizontally. This, they consider, shows that the Middle and Upper Glacial deposits, which constitute an unbroken succession, were due to the gradually receding position of the land-ice during their accumulation, the sequence being terminated with the Moel Tryfaen and Macclesfield Gravels, which were accumulated during the disconnection and gradual disappearance of the ice, and while the land still continued deeply submerged.

Anthropological Institute, November 14.—Col. A. Lane Fox, F.R.S., president, in the chair.—The president read a paper on the Black Burgh Tumulus, Dyke Road, Brighton, explored by him in 1872. This tumulus, about two miles from another opened in 1856, which contained the amber cup, bronze dagger, &c., now in the Brighton Museum, was found to contain towards the centre a layer of charcoal 1′ 10″ below the surface, and extending to a radius of 20 feet. This, on being microscopically examined, was found to be oak charcoal. Portions of ribs of goat or sheep, notched apparently with a flint saw, were found, a piece of British pottery, and in the centre of the tumulus, in an oblong grave 8 feet by 12 feet, was found a skeleton in a crouching position, six feet below the surface, and crushed flat by the superincumbent earth, the face towards the south-east. These remains Prof. Flower ascribes to a female of about 5′.6″; about two feet from the feet lay a fine bronze dagger 4″ in length, with the rivets for attaching it to its handle. A curious food-cup with peculiar ornamentation on one side, and also two small discs of metal, apparently rivet-heads, together with a quantity of small flat beads, originally strung together, were found. These objects belong to the time of interment. Two flint scrapers were also found near the body. The chief peculiarities of this find are the presence of a dagger with a female skeleton and the curiously-ornamented food-cup. The president then read a paper on the exploration, in 1875, of the ditch and tumulus in Seaford Camp. In the ditch at 1 foot below the present surface were found one or two pieces of mediæval pottery, then Romano-British at about 3 feet, and below this chalk rubble evidently filled in, till the original bottom at 7 feet was found. The tumulus inside the rampart was examined, and a large flint scraper and a piece of British pottery were found at 2 feet. Below, at a depth of 3 feet 5 inches, five flint saws and more British pottery were found, also fragments of a flint hammer and a polished flint celt, originally 5 inches long, but broken into three pieces; one of the edges was chipped to make a new edge. The flint hammer was formed from a sea-worn flint pebble. The flint celt had evidently been fractured three or four times at the place of interment. Scrapers and fragments of pottery and a broken but well-shaped barbed arrow-head were also found. No trace of bone was found.—Mr. F. G. H. Price, F.G.S., then read a paper on excavations in the Romano-British cemetery at Seaford, Sussex, by himself and Mr. John E. Price, F.S.A. The authors described the cemetery and the cuttings they made in it. The surface soil, extending to a depth of about 3 feet, contained large quantities of flint scrapers, flakes, and fragments of pottery. Several urns were met with at a depth of 3 feet 6 inches from the surface, which contained, in addition to the usual calcined bones, thin iron nails with large heads, flint flakes, and bronze fibulæ. The objects found in the above excavations were exhibited, and a discussion on the three papers took place, in which the president and others joined. Maps and sections illustrated the papers.—Photographs of a so-called horned man from Akim were exhibited by Mr. Hay per Mr. Francis Galton, F.R.S.

Physical Society, November 18.—Prof. G. C. Foster, president, in the chair.—The following candidates were elected members of the Society:—Major W. Malcolm, R.E., Prof. J. M. Purser, Dr. W. Francis, Mr. G. Johnstone Stoney, and Mr. D. MacAlpin.—Mr. Tylor read a paper on the cohesion and capillary action of films of water under various conditions. The author endeavours to eliminate the action of all forces except that of gravity by immersing his "valves" in water. The models which he exhibited consisted of glass tubes about 3 inches in diameter and 6 inches high, filled with water and containing each a piston, which, on being raised, was capable of lifting by cohesion a heavy mass of metal, the nature of the surfaces in contact differing in the several instruments. From experiments with them he concludes that the time during which a heavy valve can be supported depends upon the size of the surface of contact, the difference of pressure within and without the moving parts, and the smoothness of the valve. On the contrary, dry bodies, such as Whitworth's surface planes, will adhere for an indefinite period. Mr. Tylor considers that the supporting of a body in water is due to a difference of pressure in the water itself, and he adduced Giffard's injector as showing that such differences can take place. He has also studied the form assumed by a drop of water at a tap, and considers that when a fly walks on a ceiling its weight acts in the same manner as the heavy valves in the models exhibited.—Prof. Shelley exhibited some of Sir Joseph Whitworth's surface planes and gauges, and showed their bearing on the subject.—Dr. Stone then projected on to the screen the spectra produced by the diffraction gratings, which he exhibited at the last meeting of the Society. When received on a screen at a distance of about 25 feet they showed bright bands in the red and violet, after transmission through a strong solution of permanganate of potash. Mr. Clarke has since ruled for him gratings on the backs of right-angled prisms, and Dr. Stone has cemented, by means of glycerine, or oil of cassia, gratings on glass and steel on such prisms. The lines were two thousand and three thousand to the inch.

Institution of Civil Engineers, November 21.—Mr. George Robert Stephenson, president, in the chair.—The paper read was on the fracture of railway tires, by Mr. W. W. Beaumont, Assoc. Inst. C.E.

Victoria (Philosophical) Institute, December 4.—Mr. C. Brooke, F.R.S., in the chair.—It was stated that the Society now numbered 713 members.—A paper on the Egyptian myth of Ra, by Mr. W. R. Cooper, was read.

CAMBRIDGE

Philosophical Society, November 6, 1876.—Mr. J. W. L. Glaisher made a communication to the Society on a formula of Cauchy's for the evaluation of a class of definite integrals.—Prof. Hughes exhibited three series of specimens in illustration of the mode of (1) formation, (2) weathering, and (3) fracture of flint, the first two being selected chiefly with a view to the last. He produced proofs that the supposed faulted and re-cemented flints were generally only flint that had irregularly replaced jointed chalk, the formation of the flint being arrested by the joints. In the case of the banded flints he exhibited and distinguished two kinds—one in which infiltration had taken place all round the outside, often a good test of the drift origin of certain fragments; and the other in which a difference of texture, due generally to some included organism, had determined and limited the areas over which infiltration had produced bands of colour. He pointed out that these differently coloured included portions, whether banded or not, affected the fracture, as they also depended upon the texture of the flint, but that the bands themselves had little or no influence upon the fracture. He then drew attention to a series of specimens which showed that when flint or other material of a similar texture was struck by any object such as a round-headed hammer, so that the blow was symmetrically distributed over a small area, a bruise was produced which on weathering flaked off all round a small cone having an angle at its apex of about 110°, and that when the whole had flaked away a smooth basin was left. But if, and only if, the blow was sufficiently intense to break the flint up, this cone was found to truncate a larger cone whose apex had an angle of about 30°. He pointed out that modifications of this double cone structure explained the "rings" and "bulb of percussion" which were appealed to as evidence of the direction of blows on which arguments were founded as to the origin of some stone implements.

PARIS

Academy of Sciences, November 27.—Vice-Admiral Paris in the chair.—The following papers were read:—On the crystals of magnetic oxide of iron formed during the roasting of a spathic ore, by M. Boussingault.—On various works of hydraulics, executed by the ancients in the environs of Rome, by P. Secchi. He notices, shortly, an inverted siphon aqueduct at Alatri, a complete system of drainage there, mode of supplying purified rain-water to the town of Segni, filtration through porous soils, mode of cooling the *aqua tepula*, and of removing carbonate of lime from water. P. Secchi has found the spring which furnished the *aqua tepula*; its temperature is 17° to 18° C. in winter, and it cannot have been over 18° when the ancients used it; this shows the extreme slowness of cooling in the interior of the globe.—On a remarkable fall of hail observed at Grotta Ferrata, by P. Secchi. The hail cloud appeared like an immense ball of cotton or wool, and it advanced with a whirling movement from south-east to north-west. The first rain drops were very large, at least 1 cubic centimetre. The hailstones which followed were formed of groups of crystals like those of quartz gathered round an irregular mass of ice. These groups weighed 40 to 60 grammes; certain blocks at Marino, 300 grammes. Round grains, with concentric layers, were very few. P. Secchi thinks electricity not the cause but the effect of hail.—On the composition of gun-cotton, by Prof. Abel. This refers to a note by MM. Champion and Pellet.—On a new electric repulsion and its application to the theory of comets, by MM. Reitlinger and Urbanitzky. Operating with air, oxygen, hydrogen, nitrogen, &c., in Geissler tubes, they got, under pressures of 2 to 8 mm., the usual attraction in the luminous column when the finger, or any conductor was brought near; but, pursuing the rarefaction further, a repulsion. Using a tube like an electric egg, the nebulous light was like the tail of a comet, and the repulsion was very strong, and manifest at a great distance.—On the portative force of horse-shoe magnets; extract from memoir by M. van der Willigen. To saturate his magnets he places them vertically with their poles on those of a Ruhmkorff coil, the circuit of which he opens and closes several times; the magnetism in the magnets then reaches its maximum, even supersaturation. After the last opening, he slides the magnet carefully towards the edges of the polar planes of the electro-magnets. Then he puts the well-cleaned support before the magnet, inclining the latter slowly. Immediately the support has joined the magnet, the latter can be removed without effort; its portative force is then nearly a third greater than the permanent portative force of M. von Wetteren's best magnets. This state of supersaturation he makes the starting-point of his researches.—Researches on the vitality of the eggs of phylloxera (second paper), by M. Balbiani. He examines the action of alkaline sulphocarbonates, sulphide of carbon, and empyreumatic products.—Treatment of phylloxerised vines, by M. Boiteau.—On a question of ballistics, by M. Astier.—On the determination of groups formed of a finite number of linear substitutions, by M. Jordan.—On the application of methods of mathematical physics to the study of bodies terminated by cyclides, by M. Darboux.—Construction for a point of the curve of intersection of two surfaces with the centre of the osculating sphere of this curve, by M. Mannheim.—Explanation of actions at a distance; gravitation, electric actions, by M. Picart. He explains all phenomena by matter in motion.—Crystals of gallium, by M. Lecoq de Boisbaudran. These are octahedra truncated at the base; the angles indicate a clino-rhombic form.—Note on the determination of sugars by means of titrated liquors, by M. Perrot.—Second note on testing for fuchsine in wines, by M. Fordos.—Researches on the real origin of nerves of general sensibility in the medulla oblongata and the spinal chord, by M. Pierret.—On the physiological action of temperatures below zero, on silk-worm grains, by M. Duclaux. To the limit, at least, of − 10°, the effects produced on the grain by lowering the temperature are comparable in their nature, and differ only in their intensity; this intensity does not increase or decrease regularly with the temperature, but presents a maximum for a certain point of the thermometric scale. This physiological zero of the grain is probably a little above the ordinary zero.—On the structure of the optical system in crustaceans, by M. Chatin.—Synoptic table showing the distribution of fossil molluscs in the Tertiary layers of the Paris valley, by M. Meunier.—On a crystallised silicate of baryta obtained artificially, by M. Pisani.—On the study of the barometer, by M. Wickenheimer. 1. The mean of barometric observations, made at any hour for all the days of the month, gives a constant number, whatever the hour. 2. The barometric height passes two maxima and two minima daily. 3. The annual barometric mean is constant for all hours of the day.—Observation of descending trombes, made at the Cape of Antibes, November 21, 1876, by M. Ferreri.

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